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The Canadian
Medical Association Journal

Vol. X. TORONTO, AUGUST, 1920 No. 8

PRESIDENTIAL ADDRESS

By Robert E. McKechnie, M.D.

Vancouver, B.C.

MY first duty on rising to deliver the customary Address of the President at our annual meeting is to express to you my thanks for the high honour you have conferred on me by selecting me as your president, and also to express the thanks of the medical profession in British Columbia, that this province was selected for the 1920 meeting. We are so far away from the centres of population in the east that some may have had doubts as to the wisdom of such a decision, and grave doubts as to the success of the meeting. Such doubts are largely due to your want of knowledge of what the west is, and what the west has done, and I therefore propose to take up part of my time this evening in telling you about ourselves, not in a boasting spirit, but merely, so to say, for an educational purpose. The east is insular in its outlook or rather the outlook is from a series of islands. Montreal's problems are confined to the Island of Montreal, while farther west are the Islands of Frontenac, York and Lambton. Each views the world from its own viewpoint, from its own shut-in exclusiveness, and in the usual insular spirit considers its own little island the best. Just like the insularity of the Englishman, but in your case, as in his, we can justly say you all have good cause to be proud of yourselves, of the work you have done and of the work you are doing. But out west, from the Red River to the Pacific we are one country, with the similar problems of a rapidly growing country to face and overcome. And with our distance from the east we have a better perspective, and seeing better, being free from local prejudices, can the better criticize and so arrive at, we trust, a just appreciation of ourselves. And strange

to say the men of the west do not look upon themselves as being the weak brethren of the profession from the hinterland and from the backwoods, but somehow have got to feel that the profession in the west is the equal at least with that in the east. And so you see we too are insular, only our island is larger. Our men think very little of the long trips to other centres of medical education and your various clinics yearly see a number of us. Chicago and New York and all the other American centres are visited continuously, with Europe not omitted, and so the lamp of knowledge is kept burning. We think this custom is more widespread in the west than to the east of the Red River, although the west joins hands at every big convention with a faithful band from the shores of the Atlantic. Perhaps the absence of the big schools forces this upon us but to the credit of the west we must say that her sons do not grudge either the time or the money needed for these frequent trips. But enough of this self praise, perhaps you say, too much.

We are a young country out here. Speaking for British Columbia the first medical men of whom we have record as having visited our shores, were William Anderson, surgeon on H.M.S. *Resolution* and John Law, surgeon on the *Discovery*, accompanying Captain Cook in his third and last voyage in 1778. Anderson shortly died of consumption and Cook appointed Mr. Samual, surgeon's first mate as surgeon to the *Discovery*, removing Law to the *Resolution*.

Again in 1792 Galliano and Valdez, in their Spanish warships, explored the Straits of Juan de Fuca, and later the west coast of Vancouver Island, anchoring in Nootka Sound where they were joined by the transport *Aranzuzu*. This latter had on board a surgeon, Louis Galvez, of whom Galiano observes, "That the crew had great confidence in his skill."

Captain Vancouver appears now with these Spanish explorers, visited them at Nootka in 1792, where he took these new lands from the Spanish, as the agent of the British. He had three surgeons with him, Cranstoun on the *Discovery*, Watson on the *Chatham*, and Menzies as surgeon's mate. This last one succeeded Cranstoun who was invalided home in 1792.

Menzies was the most important member of this group. He really joined the expedition as the scientific man of the party. He was Edinburgh trained, and as good a physician as a scientist. Vancouver complimented him at the end of the voyage, pointing out that no life had been lost through sickness during the voyage after he succeeded Cranstoun, a period of three years.

During your rambles on the coast you will have pointed out to you the arbutus, its beauties thus sung by Bret Harte:

"Where, where shall I begin,
Who would paint thee, Harlequin?
With thy waxen, burnished leaf
With thy branches' red relief,
With thy poly-tinted fruit,
In thy spring and summer suit."

This is the Arbutus Menziesii, so named by the botanists in his honour. Menzies made great collections of the plants, etc., of this coast, and to-day these can be found in three sets; one in the British museum; one at Kew, and the third in the herbarium of the Botanical Society of Edinburgh.

But these men were but passers-by, interesting from an historical point of view, but not our real pioneers. From 1792 is a blank in medical history, until we come to 1850, when modern medical history begins in British Columbia. In this year the Hudson Bay Company brought out on a ship around the Horn a cargo of goods suitable for trading, and also a full complement of men to establish a post, farmers, carpenters, blacksmiths, school teachers, a parson and a doctor. This latter was John Sebastin Helmcken, still living in the city of Victoria at the ripe age of ninety-five and still possessed of a goodly share of his faculties. It is thus seen how young the medical history of this part of the Dominion is when the first resident practitioner is still living. Dr. Helmcken was born in London, England, in 1825, and received his professional education at Guy's.

Describing his early years out here in the Crown Colony, he quaintly stated at one of our medical dinners in Victoria, some years ago, that in the early days he was the leading practitioner from San Francisco to the North Pole, for there was no other doctor in this vast extent.

One of his duties was to put up medicines for the various Hudson's Bay Company's trading posts up the coast and in the interior, for Victoria was the distributing point. The factors at these posts had to do their best to treat what came their way, and as their medical skill was nearly a negative quantity, the medicines sent had to be divided into their proper doses and properly labelled. Following Helmcken were men distinguished in their day (and some are still with us), for their solid worth and brilliant accomplishments, John C. Davie, J. W. Powell, S. J. Tunstall, O. M. Jones, and looking towards the east, McKid in Calgary, Mewburn in

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Lethbridge and Calgary, and the old war horses Chown and Good in Winnipeg. These men served to blaze the trail, since followed by so many hundred feet, until to-day we count the profession in the four western provinces, not by the hundreds, but by the thousands.

What are these thousands doing? Many in isolated localities are doing their work of service with little help and little encouragement beyond the knowledge that their work is service, and as such the highest aim of the profession. Who is the man longest remembered when dead and gone—the one who made a financial success or the one who crowned his life with loving service like the doctor in Drumtochty?

As Elbert Hubbard said of Lincoln, "The memory of his gentleness, his patience, his firm faith, and his great and loving heart are the priceless heritage of a united land. He had charity for all and malice towards none; he gave affection, and affection is his reward. Honour and love are his."

While the first one, the mercenary one, is bringing a shadow on the page of life, the latter is illuminating the missive with pictures of divine workmanship. Service is what counts, and taking that as a text, what service is the profession in the west giving which is not selfish service?

Present day practice is so bound up with hospital work that it is hard to separate them, the doctor and the hospital are as inseparable as the parson and the church, and yet each can do good work without either hospital or church.

But the majority of our practitioners are close to hospital conveniences, so if I point out how the west is blazing the way to public service through its hospitals I will be but showing you the work of the profession from another angle. I shall return to this in a moment, when I will take Saskatchewan as an example. But the west has blazed a way in other lines not medical. Victoria was the first city in Canada to have an electric tram. Vancouver was the first city on the continent with a whole automobile fire-fighting equipment. Vancouver pioneered the way in Canada with its medical inspection and school nursing; the University of British Columbia was the first to establish a Faculity of Nursing; even the Canadian Pacific Railway was begun at this end.

Now to return to Saskatchewan. This province has the same problems confronting it as are found in the other western provinces, and also in the more sparsely settled eastern provinces. Here, men, women and children constitute her greatest wealth, and so

conservation of health is also conservation of wealth. Realizing this and knowing that thousands of her inhabitants were lacking in the proper facilities for best caring for the health of her people, she has attacked the problem in a vigorous and highly creditable manner. Undoubtedly the best work of the medical man can be accomplished in hospitals and so this western province has essayed to give her medical men the best opportunities to care for the health of her people. It was realized that the old method of maintaining hospitals by voluntary contributions had proved inadequate. The Union Hospital Act was therefore enacted whereby two or more municipalities could co-operate in establishing rural hospitals. Authority was given to issue debentures to furnish the money to build and equip these hospitals while the interest on the debentures as well as the expense of administration is to be met by a tax on the municipalities. This tax really works out as a small amount, about $3.12 per quarter section, so that the whole community pays for this service. Residents in the municipalities are not charged for their hospital care, they are not charity patients, they pay for it through their taxes. An *x*-ray equipment is furnished with a trained nurse, specially qualified to run it. A small laboratory is also available where ordinary examinations can be made by the doctor, while, for special work arrangements are made whereby specimens are sent to the Public Health Laboratory in Regina, where the pathologist makes his examinations and forwards his report promptly.

This is an example of hospital service to the community and service to the profession which is to be highly commended. The hospital forms a sort of medical centre where doctors must meet and cannot help but discuss their difficulties and receive mutual aid, and where they are also put in possession of facilities for doing better work which otherwise they could not afford to possess, where the youngest graduate can have the same opportunity to do as efficient work as his older brother. And all this is in the line of increased service to the community.

But how about our hospitals in the larger centres? Those connected with the medical schools find their service in providing facilities to students to obtain their clinical training. Such hospitals must necessarily be closed hospitals if they would hope to do the best work. I have no criticism to offer about this class. There are other large hospitals whose service is limited because their benefits are limited to but a small number of the practitioners in their district, and if we try to disarrange this system we are apt

to disturb a hornet's nest. Those doctors who are specially benefited by a closed system will naturally oppose any change. The hospital authorities will say it is much easier to run a hospital with a limited number of attendants. The ward nurses will say it is ever so much easier to look after a ward filled with one doctor's patients, than if ten or a dozen are giving orders and each with his own pet fads to be remembered. The operating-room nurses will tell the same tale, for one wants chromic gut when another wants plain; where even the instruments that will suit one will be turned aside by another. But because a service is easier is not proving that the more difficult plan is not better. If it is better then the public has a right to demand the best.

Rutherford B. Hayes in his inaugural address in 1877, said, "The president should strive to be always mindful of the fact that he serves his party best who serves his country best." And so we too should say that the doctor serves his profession best who serves his community best. The true physician should be more zealous of the honour of his profession than of his own personal interests. Broadening the service of our hospitals in order to be a greater benefit to the community at large, even if it be at some personal sacrifice, will undoubtedly redound to the honour as well as the benefit of the whole profession.

As the Honourable John Oliver recently said before the meeting here of the Canadian Manufacturers' Association, "Wealth is not the measure of success, but service is."

Perhaps a concrete example will best illustrate my argument. For this example I will take the Vancouver General Hospital with its 1,300 beds, not only the largest open hospital in the Dominion, but the largest hospital.

A glance at the doctors' register would show that one hundred or more doctors each day visit the hospital.

Some of these doctors are on the staff, the majority not. Every doctor in good standing in the community can send his cases in, whether paying or not, and can attend them, whether paying or not.

The hospital itself is equipped with a pathological laboratory in charge of a skilled director and a full staff. There is an up-to-date *x*-ray department in charge of an expert. There are electrical, hydro and physico-therapy departments, properly equipped and properly run.

Now, what happens when a doctor not on the staff sends in a non-paying patient? That patient has as much claim on the

services of the hospital as the paying patient of a staff man, and gets it. The whole services of the hospital are put at the disposal of the youngest doctor in the city, for the benefit of the patient and for the benefit of the doctor. Is it not to the interests of all that every doctor should have every aid which will help him in his work?

How long does it take the beginner to get even a moderate outfit, how many old practitioners ever get a full outfit? The full outfit is only found in the well equipped hospital and is paid for by the public. Every member of the public has a right then to the full use of that equipment whether his physician is staff or non-staff, whether the patient is paying or non-paying. This is service, and is the kind of service the Vancouver General Hospital is giving to its public, and to its visiting doctors.

We hear to-day much about group medicine. A group of doctors representing the various branches of medical work get together, form a company or association and proceed to run the practice of medicine as a close corporation. It would not be attempted if it were not money-making, hence selfishness is at least one of the underlying reasons why these clinics are started. While such clinics can be, and are run honourably, and good work is done, still the system is susceptible to great abuse and many are already earning unsavoury reputations. If we would avoid evil we should also avoid the appearance of evil. Yet such clinics undoubtedly in some localities fill a want and furnish a service.

I like the idea of group medicine but not that kind, not the selfish kind. With a well equipped hospital giving equal facilities to all, there is no need for a private clinic, but each doctor practising in the community will belong to this great public group and will enjoy all the advantages which can be furnished by a private group, and the whole public will benefit accordingly.

So the legend of the Vancouver General Hospital is "service".

Before closing I wish to say a few words about the committee of arrangements of this meeting. The credit of this successful meeting is not due to the president, but to the members of a very efficient and hard-working committee who loyally shouldered the burdens cast upon them and each in his sphere tried to make a success of his department.

To these men the thanks of the Association are due, and I myself most heartily accord to them their just due.

A STUDY OF EPIDEMIC ENCEPHALITIS BASED ON THE STUDY OF SEVENTEEN CASES WITH TWO AUTOPSIES

By Colin K. Russel, B.A., M.D.

Lecturer in Clinical Neurology, McGill University, Neurologist, Royal Victoria Hospital

In recent years the attention of the medical profession must necessarily have been called to the fact that the human race is the subject of disease in epidemic form to an extent that was not noticeable a few years ago. World epidemics of poliomyelitis and influenza are of too recent and too serious a nature to need to be recalled. Associated with the recent epidemic of influenza, at least in point of time, and yet in its appearance recalling the symptoms of poliomyelitis, is the disease which I would like to call your attention to, namely: acute encephalitis.

Here, in Eastern Canada, we have been relatively free from this disease compared with the Western Provinces, the United States, and England. Whether our relative immunity is to be continued or not is still to be decided.

Acute inflammation of the brain in epidemic form is not a new disease; Barker quotes an epidemic reported by Camerarius in 1718; another by Lebecq de la Cloture in 1763 and three mentioned by Ozamann in his "History of Epidemic Diseases" as occurring in 1785,1800, and 1802. An epidemic of encephalitis has been described by Lichtenstern after the great influenza epidemic in 1889 and 1890. As far as I have been able to learn, the disease was first recorded in the United States in the winter of 1918-1919, under the misleading name of "Sleeping Sickness", and about the same time cases were reported in France and England and also in our western provinces. In the Province of Quebec no cases, I believe, have been reported

Since this manuscript was submitted two other distinct types of the disease have been observed. One with purely psychic symptoms of a confused dementia type, and the second occurring in a young boy, consisted in some slight mental change, some change in the voice, but what was most noticeable and intractable was persistent nocturnal insomnia.—C. R.

until this winter when we have occasionally seen articles in the daily press announcing that such cases have been under observation in one or the other hospitals. I have no doubt that such cases have occurred but perhaps have not been recognized as belonging to this type of disease.

The following study of this disease is based upon observations on seventeen cases, all of which, with the exception of two, came under my own personal observation. The symptoms of the disease itself are in no manner remarkable, the most striking symptoms, however, depend entirely on the site of the brain affected. While the majority of cases have been in young or middle-aged adults, one case in this series was in a child of eighteen months, another in one of seven years, and another in a man of sixty-seven years of age. The average age of the others was twenty-nine years. Sex showed no influence on the incidence of the disease, there being nine males and eight females in this series. In no case has there been any history suggesting the source of infection, and in no case does it seem to have been associated with influenza.

The onset of the disease varied considerably, usually there is a feeling of general malaise for a day or two before the onset of the symptoms referable to the actual lesion in the nervous system. In two cases the disease was absolutely sudden. Vomiting and diarrhœa were present in the younger children and a left-sided convulsion was among the early symptoms in the case of the infant eighteen months old. This, of course, could hardly be looked upon as a prodromal symptom but was evidently due to a focal lesion. In two cases somnolence was the first symptom noticed. One patient found great difficulty in carrying on her work as a domestic on account of the impossibility of staying awake. If she sat down for a moment she promptly fell asleep at any time of the day and had to be wakened up. The other patient would get on a street car and promptly fall asleep. On being awakened she would tell the conductor that she could not stay awake and he must put her off at a certain street. On one occasion she went to meet some friends at the railway station but fell asleep and missed them and was found in the station a few hours later still asleep. In most cases there has been a slight febrile period at the onset. In one case in whom the disease developed while under observation for some other trivial matter, the temperature did not rise above 99 4-5° and in only two cases was it above 100° during the whole course of the disease, excepting in the terminal stages when other complications accounted for a more elevated temperature. Ac-

cording to the localization of the lesion this disease may, broadly speaking, be divided clinically into three types:

1. Those of an hemiplegic type where the disease is localized in the cerebral hemisphere.

2. The paralysis agitans type where the incidence of the disease is in the lenticular or subthalamic region of the basal nuclei.

3. The somnolent type where all the symptoms point to a lesion of the posterior part of the pons.

Of the First or Hemiplegic Type. In this series there are three examples. In one, seen in consultation with Dr. Walter Fisk in July, 1919, an infant with a left-sided hemiplegia and complete blindness evidently due to involvement of the occipital lobes, and a widespread involvement of the right hemisphere. The onset followed a fall from a gallery a distance of several feet but without loss of consciousness. There was some vomiting and diarrhœa the same night followed four days later by a left-sided convulsion which was repeated three days later, after which consciousness was lost and a definite hemiplegia was evident. The temperature ranged from between 103° and 104°; the spinal fluid obtained by lumbar puncture contained 280 cells to the c.mm. but did not appear to be under any great pressure. The fundi were normal. The pupils were equal and active to light. The left eye turned in as from paralysis of the external rectus, but the child's attention could not be attracted to make him move either eye. There was no movement on the left side of his face on crying, though both eyes winked equally well. The right arm and leg showed voluntary movement, but there was complete paralysis of the left side with increased deep reflexes and extensor plantar response. After having him under observation for ten days, it was considered advisable to make an exploratory trephine opening to exclude extra meningeal hæmorrhage. The operation was performed by Dr. Scrimger and a condition of encephalitis was discovered. The patient regained some power in his left leg and arm but remained blind.

The second case seen in consultation with Dr. Harry Shaw, showed a marked though temporary aphasia with a right hemiparesis. The onset followed a period of general malaise lasting for a day or two and came on while the patient was viewing some street parade. There was no loss of consciousness and very little fever. The pupils were equal and active. Slight weakness in the right arm and leg with increased deep reflexes and a right side Babinski. The type of aphasia was motor with practically complete comprehension of language but an inability to recall names

and some difficulty in pronouncing. The hemiparesis cleared up but left the patient with a slight motor aphasia.

The third case, a young woman of thirty-three years, seen in consultation with Dr. Cushing, showed left hemiplegia. The onset in this case was sudden on March 1st. At ten minutes after eight she was well. At that time she suffered with a severe pain in the occipital region and vomiting of a projectile character. She was admitted to the hospital, the headache and vomiting still persisting. The patient had no fever. Lumbar puncture was performed with great relief to the headache and the cerebro-spinal fluid showed practically pure blood. Her white cell count showed 20,000 leucocytes. Her blood pressure 120 maximum; 80 minimum. Ten days later she became quite irrational and during the next three days developed gradually a left hemiplegia with increased deep reflexes, a Babinski, and absent abdominal and epigastric reflexes on that side. The Wassermann in the blood was negative. Lumbar puncture at this time showed a yellowish coloured cerebro-spinal fluid due to blood pigment. There were between 700 and 1,000 cells to the c.mm. and on staining, these were found to be altogether small and large mononuclear cells. In conjunction with the low blood pressure and leucocytosis in the blood the condition was looked upon as encephalitis with hæmorrhage into the inflamed area in the right hemisphere. The patient made an almost complete recovery and was discharged from the hospital on April 17th. There was no fever at any time during the course.

Of the Second or Parkinsonian Type. This series show three cases besides two of which had a more widespread involvement with evidence of lesions in the pons as well as the subthalamic region, and come into the third or Pontine type as well as into this.

The first case of this type was a girl of thirteen years old who presented the picture of lenticular degeneration so well described by S. A. K. Wilson. On admission she appeared to be mentally simple and was very hazy in her history of the onset of her illness. She had a marked dysarthria which seemed to be due to rigidity and inco-ordination of the muscles of articulation. What was most striking, however, was her extreme emotionalism. While examining her, for no obvious cause the patient would burst out crying, holding the mouth wide open and tears starting from her eyes but making no noise whatever. A moment or two later it was impossible to tell whether she was laughing or crying, and in the middle of this proceeding in response to questions she would explain that she was not feeling badly and that she could not help laughing or crying, but

she was not thereby expressing her feelings, and from her explanation one felt sure that there was not sufficient emotional disturbance to explain her emotionalism. She was unable to feed herself on account of the shaking of the hand on volitional movement. There was no evidence of involvement of any of the cranial nerves or of the pyramidal tracts or sensory system. Her reflexes were all normal. There was, however, in all the voluntary muscles evidence of a marked increase of tone in some more than others, and especially was it more marked in the proximal segments of the limbs than in the distal. The abdomen was board-like. Any strong muscular action produced coarse tremor of the extremity. The feet were held in a position of equino-varus with the great toe in strong dorsal extension. In attempting to walk the patient had to be supported. She inclined forward and to the left, but after walking a little straightened up better, stepping forward with the right foot in short steps and dragging the other foot after it in a spastic manner.

The second case is included although she was not seen during the acute stages of her illness, but gives the remarkable history of somnolence already quoted above. She came to the Neurological Out-Patient Department complaining of involuntary movement of her left arm and leg which, associated with her previous history of somnolence, is so suggestive and so similar to the cases described by Pierre-Marie and Levi, with symptoms the sequelæ of encephalitis. In the absence of any of the ordinary signs of involvement of the pyramidal tract and in the presence of normal reflexes, I realize that one has to exclude hysteria, and her history in this respect is suggestive, but there is no other evidence of hysteria in her present mental make-up, and failing an opportunity to clear it up by suggestive methods, I have included her as an illustration of the sequelæ in this disease. The spasm of the right arm is more or less rhythmical and is increased by voluntary effort. The fingers flex; there is slight ulnar flexion of the wrist followed by extension of the wrist, flexion at the elbow and adduction of the arm to the chest. At the same time the leg is flexed at the knee and extended at the ankle with inversion of the foot. It is associated with more or less severe pain in the region of the ulnar nerve disturbance in the arm and forearm.

The third case—and I am indebted to Dr. Leo Mason for permission to see this patient—presents a practically similar picture to the fourth, save that there is no evidence in his case of any lesion of the pyramidal tract. A man of sixty-two, formerly healthy, a guide

in the Adirondacks, taken suddenly ill with coryza and headache. Brought home he became delirious, but had no fever when examined at this time. Following the delirium which lasted for about a week, he developed marked tremours of the extremities, especially the left hand, increased on volitional effort. Now, three months after the onset of his acute illness, he presents all the characteristic symptoms and signs of severe paralysis agitans, especially marked on the left side.

In the fourth case of this type, a young woman of twenty-three years of age, the onset was sudden while the patient was under observation for some gynæcological condition. She fell when walking to the lavatory and on examination showed marked twitching in the muscles of the hands and face. There was a marked ocular nystagmus and nystagmoid jerkings of the eyelids and the tongue. The tendon jerks on the right side were increased and she showed a right sided Babinski. There was no sensory loss. Her temperature was 99 2-5°. Examination of the cerebro-spinal fluid unfortunately was not carried out for some time and then proved normal. Wassermann of the blood and cerebro-spinal fluid was negative. She suffered from involuntary micturition. Marked contractures of both legs developed which were in time overcome to a large extent with a great deal of difficulty, so that the patient could walk around. She now presents the picture of paralysis agitans—the same increased tone of the muscles, the mask-like expression, the serpentine unwinking gaze, the characteristic attitude of the body and the typical gait with the tremour described by Parkinson.

The fifth case also showed evidence of involvement not only of the pons but also of the subthalamic region. The onset (December 1st) was with general malaise, diplopia, dizziness, some headache and somnolence. Upward and downward movement of the eyes was impossible and there was a marked nystagmus. There was a marked increase of tone in the muscles of the extremities and a development of muscular twitching affecting the body and extremities; in some delirium and involuntary micturition with the development of bedsores and the formation of marked contractures of the legs. At no time has there been any pathological reflexes to suggest involvement of the pyramidal tract. Leucocytosis was present in the blood and increased cell count averaging about twenty, with an increase of globulin in the cerebro-spinal fluid. Any attempt at volitional movement of the legs produces a rhythmical contraction of the hamstring muscles.

The most striking feature of these cases in the early stages

was involuntary twitching of the muscles of the body and extremities during the acute stage.

Pontine and Somnolent Type. Nine cases of the series belong to the Pontine and Somnolent type as evidenced by nystagmus, sometimes also some ocular paralysis such as loss of upward and downward movement of the eyes, or diplopia and most marked somnolence. It is cases of this type which suggested the name "Sleeping Sickness" or Encephalitis Lethargica. The appearance of these patients is most remarkable and when once seen is not easily forgotten. They lie in bed like a figure on a tomb with an absolutely expressionless face; the eyes half closed and as a rule without expressing any desire of any kind and with no complaints. If spoken to they may rouse easily and answer promptly and apparently intelligently, although closer examination shows a more or less marked degree of mental confusion. They express themselves as feeling "fine", and without pain, and promptly fall into their condition of somnolence. More or less transitory paralysis of the various cranial nerves may be noted. For instance, a ptosis or a facial paralysis, or as in one case, an involvement of the motor 5th, with paralysis of the muscles of mastication on one side. In one case of this type there was for a few days evidence of involvement of the pyramidal tract on one side, but this passed away.

One might add the medullary type as a 4th group and this series showed one example where the lesion was in the medulla opposite the 4th ventricle affecting the 7th nerve nucleus causing a bilateral facial paralysis, and it should be remarked in passing that in this case there was no history of ocular involvement nor of somnolence. In the last case, however, which I saw with Dr. Harry Shaw, the lesion evidently involved the lowest part of the medulla and upper part of the cord causing paralysis of the muscles of the neck and some laryngeal paralysis, there was a history of marked somnolence lasting for over a week.

I would suggest that the somnolence so characteristic of this epidemic depends entirely on the site of the lesion in the posterior part of the pons near the aqueduct of Silvius or in other words where the flow of the cerebro-fluid from its origin in the cerebral hemisphere to the spinal canal could easily be interfered with by a small amount of swelling closing off the canal of the aqueduct. For instance, or in the extreme lower end of the 4th ventricle, blocking of the foramen of Magendie with a relative damming back of the fluid and the formation of an acute hydrocephalus.

Lumbar puncture shows a slight increased pressure of the cerebro-spinal fluid in the first few days especially, though later,

and as the patient improves this pressure may be reduced to normal. In all cases, excepting one, which were seen early, there was a small increase in the cell count made up of lymphocytes, but in one case the cell count was normal and the amount of globulin was considered normal in three cases, two of which showed an increased cell count and increased pressure. Culture from the cerebro-spinal fluid was invariably reported negative, but anærobic methods were not used. In the blood there was practically invariably an increased leucocyte count varying from 8,600 to 25,000, and where a differential count was made it showed a relative increase of the small and large mononuclear lymphocytes. The course of the disease is very variable, lasting on an average eight or nine weeks and in only two cases of this series was the recovery apparently complete. Death occurred in three cases, in two of which autopsy was obtained.

Sequelæ. Of those cases belonging to the first or hemiplegic group, one was left with complete blindness and a left hemiparesis. Another was left with a slight motor aphasia, the right hemiparesis having cleared up entirely. The third case made an almost complete recovery of a left hemiplegia but is still left with some clumsiness and awkwardness in the left hand. The cases representing the Parkinsonian group are most interesting with regard to the sequelæ. Two cases, one of whom was a young woman of twenty-three, the other a man of sixty-seven, but in whom there had been no evidence of anything approaching paralysis agitans before the onset of the illness were left with the most characteristic picture of Parkinson's disease. Another case who is still in the hospital is suffering from the most exaggerated contractures of the muscles in the thighs and legs, and from an increased tone and tendency to contractures in the upper extremities and the muscles of the back. Any attempt at volitional movement sets up a more or less rhythmical contraction of the hamstring muscles.

The fourth case showed this peculiar rhythmical tic-like contraction of the left arm drawing it up across the chest and accompanied by a sort of a kicking movement of the left leg. The origin of these disturbances of tone of the muscles is evidently outside of the upper motor system or pyramidal tract and is due to involvement of what might be called an extra pyramidal motor system. One appreciates the maxim formulated by Hughlings Jackson that a negative or destructive lesion of any system cannot in itself produce positive symptoms, that is, positive symptoms must be produced by the action of unaffected systems acting without the control or influence of the destroyed system. Similar disturbances of tone are seen in the progressive lenticular degeneration described by

Wilson where the lesion is found in the lenticular nuclei; somewhat similar disturbances of tone are also found in the muscles of old people without necessarily any lesion of the pyramidal tract, producing the shuffling gait so characteristic of the aged, and shown by Pierre-Marie to be dependent upon what he described as "les petits foyers lacunaires de desintegration" in the lenticular and subthalamic regions. All the symptoms in these cases point to destructive lesions of these areas.

Pathology. The pathological picture varies, of course, with the site of the lesion, but the most striking thing is a peri-vascular lymphocytosis in one region or the other, associated with petechial or even larger hæmorrhages. There may be associated also a mild exudative meningitis. Examination of the pituitary gland showed nothing abnormal. Straus and Lowe by using Noguchi's method for cultivating anærobic bacteria have found a filtrable organism, small and globular purplish or bluish bodies when stained with Giemsa solution or methyline blue after preliminary fixing in methyl alcohol. These occur singly or in diplo form, sometimes in chains or clumps; they are not motile. The organism resembles that described by Flexner and Noguchi in cases of poliomyelitis. The Berkfelt filtrate obtained from nasal pharangeal washings they found to produce lesions when injected intracranially into rabbits in 78 per cent. of the cases tested. They have recovered the virus in eleven out of the seventeen cases where it was injected. They found also that the inocculation of rabbits with the cerebro-spinal fluid of patients with epidemic encephalitis confirmed the diagnosis in twelve of sixteen fluids injected, and they obtained a positive culture from the cerebro-spinal fluid of patients in ten out of twenty cases. These positive results with the cerebro-spinal fluid, of course sharply differentiate this disease from poliomyelitis.

Treatment. With regard to treatment, lumbar puncture and the withdrawal of large quantities of cerebro-spinal fluid seems to give not only immediate relief to the patients in the early stages, but is, I think, of definite therapeutic value. In one case of this series belonging to the Pontine and Somnolent type, it has been found impossible to draw off more that twenty or twenty-five c.c. at the time. No more would come, and my own feeling is that this may be due to a blocking off of the aqueduct of Silvius as described above. Whether relief would not be obtained by a puncture of the ventricle is still under consideration. Theoretically, it seems to me that a puncture through the corpus callosum and establishment of drainage into the lepto-meninges is indicated.

RECENT ADVANCES IN TENDON TRANSPLANTATION AND BONE GRAFTING

By W. G. Turner

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THE title of the paper naturally implies that these advances have been made or proven through the exigency of the results of war. This last overshadowed all ordinary production and prevented the regular trend of research and experimental work. The time of those qualified for such work, who were obliged to remain at home, was so occupied by over-taxed daily routine that further work was an impossibility. The demands from the military side on the medical service, however, did emphasize certain principles in practice before the war. The word demands occurs to me as appropriate; as the army demanded first, the categorizing of men for active service and then that before a man was discharged from the army his rating as an effective should be as high as possible, and finally that his charge on the country, or pensionable disability should be reduced to a minimum. Prophylaxis wiped out typhoid and tetanus, but what about surgical prophylaxis?

The beginning of the campaign found the service prepared for casualties to a certain percentage of the troops engaged. But the lesson of attending to and segregating the hundreds of thousands of casualties could not be learned in a short time. In our own Corps there was probably an average of 15,000 casualties in each major field operation in which it was engaged. In addition it must be noted that the organized activity of the medical services saved many more lives proportionately than in previous wars and this fact demanded great expansion in the number of beds in the various home bases. It is very true the statement of Sir Robert Jones, "That one of the greatest tragedies of the war was the results in the early fractures, particularly of the femur." The various links in the chain of prophylaxis were rapidly forged and preventive orthopædic practice was adopted. The segregation and treatment of femur cases was a triumph and there was a constant

and remarkable improvement in the treatment of fractures, with corresponding diminution in the occurrence of malunion and nonunion. There was also a marked decrease in the number of cases of splint and ischæmic disabilities.

At the Granville Special Hospital, Buxton, and the Orthopædic Division of the St. Anne Military Hospital, large numbers of these post-war disabilities came into the writer's services. There were many war nerve lesions, ununited and malunited fractures. Of the former musculo-spiral, median and ulnar nerve conditions of the arm and the sciatic trunk, or the two divisions of the same, were frequent. The musculo-spiral lesion does not cause serious disability from sensation, but the muscular disability from this lesion is very great: wrist drop, the peculiar extension by the lumbricales and the adducted thumb. The great disability of this last may be overlooked until one considers how useless is the hand in which the fingers close on the thumb. The results of early nerve suture have been fairly satisfactory, but this procedure has been carried out in a relatively small percentage of cases owing to the presence of sepsis and infected fractures as complications. Permanent nerve disability has been of frequent occurrence. What is the remedy? A satisfactory procedure has evolved from our ante war experience of tendon transplantation and the results have been excellent. The first disability was to meet or counteract *the wrist drop*, i.e., to restore power to the long and short wrist extensors. On the flexor side the muscle which could be best spared and also having the most satisfactory anatomical position was the pronator radii teres. The tendon of this muscle when properly transferred to the wrist extensors will correct the wrist drop. The problem of the hand: you will remember that the extensor function is relatively gross. It exists as an opponent, to allow the fine work of the front of the hand to be accomplished. How can we compensate for this disability: abduction and extension of the thumb and extension of the fingers? On the flexor side the palmaris, flexor carpi radialis and flexor carpi ulnaris muscles can be spared without causing much disability. Insert the palmaris, if strong, into the thumb extensors, or the radialis into the thumb and index extensors, and the ulnaris into the tendons of the three outer extensors. There is no power of hand grip without wrist extension. A long J incision curved over the radial flexor side gives a very good exposure. I found a strange condition resulting in one of my cases. The primary results were good: wrist, thumb and fingers, but a few weeks later the wrist drop recurred. I again exposed the site

the pronator teres tendon. In the previous operation the two wrist extensors were transfixed, the tendon passed through and sutured with catgut. The latter was completely absorbed and the tendon, though a little scarred, was so firmly attached to its normal site on the radius that an elevator was necessary to detach it.

In cases of several thumb extensors, when the ends cannot be sutured, the supinator longus, extensor radialis longior or the radial flexor may be utilized to improve the disability.

The Median Nerve. Sensation is very important, in fact the fine co-ordinate movements of the thumb and index are absolutely dependent on the same. In our winter the percentage of disability is much increased, so much so that the individual has to estimate his activities by what the hand will allow him to do. So far no operative procedure can relieve a permanent sensory lesion. The motor disability can be improved by transplanting the tendon of the extensor carpi radialis longior to the flexor longus plolicis tendon by lateral implantation as recommended by McMurray. The result is a useful thumb.

Deltoid Paralysis. Before the war it was proven that tendon transplantation did not give satisfactory results and that arthrodesis is the real treatment.

Sciatic Nerve. A very troublesome motor disability of the trunk or external popliteal branch of this nerve is foot drop. There has been a good percentage of recovery after suture. The disability from a permanent lesion means that the individual is harnessed to a drop foot brace or the deformity becomes aggravated and more fixed. Strength for weight-bearing is the important essential. The usual muscles utilized for transplantation are the tibialis anticus and one of the peronei. The best of all tendon fixations in the leg result from the use of the tibialis anticus and peroneus brevis. The anticus tendon is exposed, and the tibia. Raise the periosteum and drill a hole through the tibia from either side two to three inches above the ankle joint. Cut off the tendon about two inches above the hole, pass the tendon through, turn it back on itself and suture it. A loop of tendon through the bone results.

Peroneus Brevis. Cut this tendon four inches above the lower end of the fibula, and then pull it through a small incision below, in order to transplant it in front of the malleolus under the annular ligament and then fix it either through the already prepared hole in the tibia, ot through a new hole below, passing the tendon in the reverse direction.

By this means a strong sling is made which counteracts the troublesome drop foot and allows the brace to be discarded.

Free Transplantation of Tendons. Considerable experimental work has been done but the only surgeon I know who definitely reports success is Sencert of the Val de Grace, Paris. I saw one case of his where there had been a large defect on front of the wrist and he had sutured lengths of sterilized dog tendons 2 to 5 centimetres long in several of the flexor tendons. Superficially he had repaired the defect with a flap. Six weeks later when I saw the case, very good function was noted and practically no scar infiltration. Other reports are very discouraging *re* scar infiltration.

Bone Graft. The great number of ununited fractures and bone defect cases have developed a procedure best calculated to give good ressults. The sites from which the graft is chiefly taken are the ilium, ribs and tibia. The jaw surgeons have found that grafts from the first are most satisfactory in jaw repair work. For the long bones the rib and tibia have been most satisfactory. The non-touch technique is naturally essential. The medullary insert has not been used so much. The essentials for a good result are: a good groove in each fragment and a well modelled graft to give enough and the best contact and fixation. There is always a marked osteosclerosis at the ends of the fragments and the contact must be carried well up into the normal bone. The best insert is that of the mosaic type which brings each region of graft and host in natural apposition. Chutro, however, has used a thin graft with very good results. When the rib is used it is modelled at each end to have a good insert in each fragment. The graft from the tibia may have the square end insert, but we have had a number of cases, especially in forearm cases, where we have employed the so-called butterfly graft—thick in the centre and tapering to a fine edge. This graft can be very accurately fitted and in many cases does not require to be tied in place. The ends can be fashioned so as to get a good hold in the medulla. The contact is excellent and almost ideal for the revascularization of the graft. In cases that have been plated without success the graft must be carried well beyond the screw holes. In one such case of which I show the slide there was a plaque of sclerosed bone across the radius. This was so hard that the saw had to be employed instead of the fine chisel. This graft is successful in the troublesome lower one-third fractures of the radius when the lower fragment at times almost touches the ulna. A good dorsal insert has enough splinting to hold the fragments.

In one case I had to divide the wrist extensors to accomplish this. These, of course, were easily sutured after the graft was in position.

In every case of bone grafting it is essential to have as much tissue as possible sutured over the graft. We have usually been able to have the graft site covered by three layers. Very careful splinting or plaster of paris fixation is necessary to ensure the results. On two occasions I used boiled bone with good result. Heitz Boyer of Paris reports twenty-five cases of using dead graft transplanted with satisfactory result, and this is confirmed by numerous other observers, though where possible the autogenous graft is preferred. Albee, Hey Groves, Gallie, and Robertson and others have written extensively on the subject. In conclusion, as a stimulus to work may I recommend the last publication of Professor Keith of the Royal College of Surgeons: "Menders of the Maimed." Lantern slides illustrating the above work and the results were shown.

In terms of the bequest made to the Royal College of Physicians of Edinburgh by the late Dr. John Parkin, Fellow of the College, a prize is offered for the best essay on certain subjects connected with medicine.

The subject of the essay for the present period is, in terms of the deed,—

> "On the curative effects of carbonic acid gas or other forms of carbon in cholera, for different forms of fever and other diseases."

The prize is of the value of one hundred pounds sterling, and is open to competitors of all nations.

Essays intended for competition, which must be written in the English language, to be received by the secretary not later than 31st December 1920. Each essay must bear a motto, and be accompanied by a sealed envelope bearing the same motto outside, and the author's name inside.

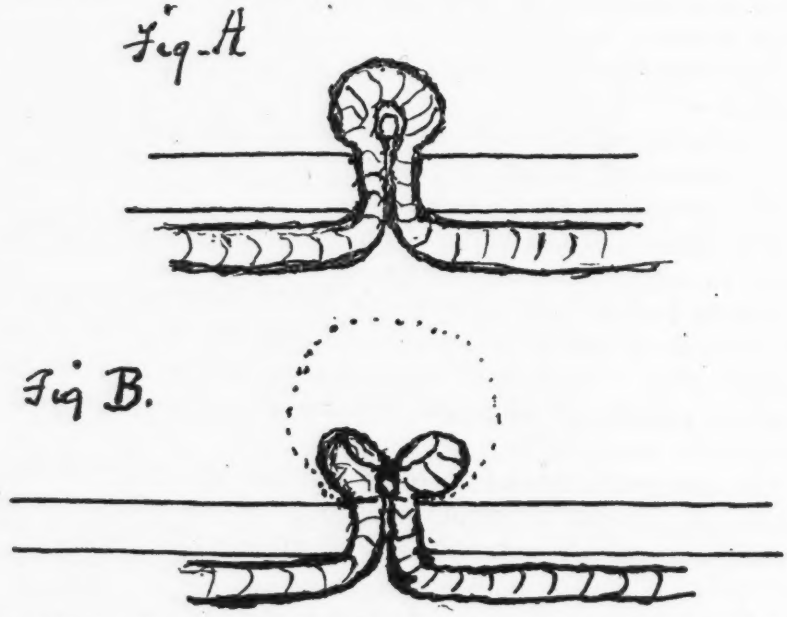
The successful candidate must publish his essay at his own expense, and present a printed copy of it to the college within the space of three months after the adjudication o' the prize.

COLOSTOMY—A SIMPLE AND INEXPENSIVE CONTRIVANCE TO MAINTAIN PERFECT CLEANLINESS

By Angus MacKinnon

Guelph, Ontario

IN performing the operation the incision should not be too long. A large knuckle of the colon should be brought out. Maydl's operation, as described by Senn, in which a glass or hard rubber rod is thrust through a slit in the mysentery to maintain the bowel well out of the wound as in Figure A, should be the one selected. The bowel should be freely divided transversely down to the posterior wall, but no bowel should be trimmed away. There will then be quite a mass of bowel external to the wall of the body. This mass will be smaller around the margins of the healed incision, presenting a neck, as in Figure B.



The dotted outline is intended to show the balloon when distended—its diameter up to about 5 inches. When empty it lies upon and protects the bowel.

The circumference of this neck, if furnished to the Sterling Rubber Company, Limited, Guelph, is all the data they require to provide a receptacle for gas or fæces, liquid or solid, so that the patient can be kept absolutely clean. It is made of thin rubber, almost as thin as toy balloons. The neck of the balloon will be so made that it will hug the neck of the bowel closely enough that no leakage will occur around it. The bowel contents are discharged into the receptacle without touching the surface of the skin. A gauze pad above and below and a suitable bandage complete the necessary equipment.

A rough sketch which accompanies this description will clearly show how simple the contrivance is, and the use of it for a short time will convince any doctor or nurse how effective it is for the purpose.

The executive officer of the Massachusetts-Halifax Health Commission has announced the appointment of Dr. Gordon Wiswell as the physician in charge of Health Centre No. 1, now conducted in Old Admiralty House, and of Dr. Hugh W. Schwartz as the physician immediately in charge of the nose and throat service. Dr. M. J. Carney, will continue in charge of at least one of the Health Centre tuberculosis clinics.

The Commission recently announced the names of a consulting staff, who will co-operate with Dr. Royer, the executive officer, in determining the policies in Health Centre work. Ther names are as follows:—Col. John Stewart, Dean of Dalhousie Medical School; Drs. Frank Woodbury, Dean of Dalhousie Dental School; Arthur Birt; George M. Campbell; S. J. McLennan; R. Evatt Mathers.

FUNCTIONING OF THE HEART IN CARDIAC DISEASE

By John A. Oille, M.D.

Toronto

THE action of the heart in disease is obviously either identical with, or at least very similar to, its action in health. Since most of us have studied its physiology, some new facts have been demonstrated that will well bear reviewing. The functions of the heart muscle fibres we learned were tabulated in the following fashion:

1. Contractility—ability to shorten.
2. Irritability—ability to receive an impulse.
3. Conductivity—ability to transmit an impulse to neighbouring fibre.
4. Rhythmicity—ability to initiate contractions or manufacture impulses.
5. Tonicity—variously defined as a state of partial contraction during rest, or simply fitness for work. (Starling).

To these one might add another, *e.g.*, adaptability. The power of the heart to adapt itself to varying needs is quite beyond our understanding, because the organ acts really as if it had a mind of its own, superior in moral respects to our other mind in that its abilities are always exercised in the best manner possible for the good of the community (of organs), always benevolent, never malevolent.

To analyse its adaptability, consider the response of the heart to exercise. With the body at rest, the heart pumps about three litres of blood per minute. In moderate exercise this amount rises to twelve, and in violent exercise to twenty-one litres per minute, and this at an increased blood pressure, that at rest being about 110 mm., and during exercise 150 to 160 mm. This means that the heart pumps the total volume of blood around the whole

Read at the fifty-first annual meeting of the Canadian Medical Association, Vancouver, June, 1920.

circulatory system several times a minute, and the actual work performed on account of the increased pressure in the aorta is therefore considerably more than seven times that during rest; that is, pumping twenty-one litres per minute at 110 mm. aortic pressure would be seven times the work at rest, and pumping twenty-one litres at 150 mm. aortic pressure would be much greater work. So it is seen that the reserve power of the normal heart is something like nine or ten times the work at rest. The curious point about the reaction to exercise is that the blood pressure rises in spite of a wide open capillary field. Therefore the heart itself is a large factor in regulating blood pressure with the co-operation of vaso-motor system, or in spite of the vaso-motor system. The open peripheral field in exercise causes or allows increased flow from the arteries to the veins, yet in spite of this the heart maintains an output greater than that escaping from the arterioles, and therefore the blood pressure rises. Now the lesson from this point is that lowering the blood pressure does not lessen the work of the heart muscle. It rather tends in average cases to increase it, as it increases the rate and output. Hence the uselessness of nitroglycerine and the nitrites in cardiac failure due to myocardial disease, or to vaso-motor failure, such as occurs in severe infections like pneumonia. Not only is such a principle of treatment useless; it is actually harmful, doing the reverse of what was intended and lessening at the same time the blood flow through the coronary arteries by increasing the rate of contraction and lessening the resistance in other parts of the circulation.

The power of adaptation is similarly shown in disease. If one produces aortic or mitral insufficiency suddenly by destroying a segment of either valve, or if one produces aortic obstruction by ligature of the aorta, the average arterial pressure is maintained unchanged. The defect is accommodated for within a few beats, practically instantly.

The adaptation of the heart to varying demands occurs equally well when the heart is completely separated from nervous control; that is to say, the controlling mechanism regulating the heart's response to varying pressures and volumes lies in the heart muscle itself. (Starling.)

In order to demonstrate this fact the so-called "heart-lung preparation" is set up. A heart is removed with the pulmonary circulation and lungs intact and so arranged that the volume and temperature of the intake through the superior vena cava can be measured and controlled, and the aortic output measured, and

pressure regulated artificially. The coronary sinus may be tapped so that the coronary flow may be estimated.

It is found that when the inflow is constant and the aortic pressure raised with a dog's heart from 45 mm. to 200 or 210 mm. that the total output is unchanged. The output is independent of blood pressure, and it seems to make little difference to the heart whether the pressure is 45 or 200. However, there is a circulatory difference one would like to emphasize. The coronary flow rises exactly in proportion to the blood pressure. When the total left ventricle putput is 850 c.c. per minute, the coronary flow is 40 c.c. with a blood pressure of 84. With a pressure of 208 the total output is 860 c.c. (unchanged), the coronary flow 260 c.c., increased six and a half times or by 220 c.c. per minute, and the systemic output therefore lessened by 220 c.c. At the same time the metabolism of the heart muscle is increased in the same proportion as is the blood flow. This is what goes on in life in simple hypertension. The blood flow is not increased. The systemic supply may actually be lessened by 200 c.c. per minute; but the coronary flow is greatly increased (six or sevenfold). This no doubt causes greatly increased coronary strain from wide variations in coronary pressure, and accounts for the frequency of coronary sclerosis in high blood pressure. Physiologists tell us that intermittent stretching of an artery is more wearing than is continuous stretching, and that an artery would last longer if its pressure were continuously 200, than if it was lowered with every diastole from 200 to 80.

This ratio of coronary flow to blood pressure is a still further reason for the harmful effect of attempting to lower the blood pressure with a failing heart muscle. Whatever the pain of angina pectoris may be due to, we know that anæmia of the heart muscle will cause pain and with already a deficient coronary supply due to a sclerotic vessel, only harm could come from causing still less blood to flow through the coronaries by lowering the aortic pressure. Fortunately this is difficult to do.

To turn now from a discussion of the effects of variations of pressure on the "heart-lung preparation" to those of altered volume of inflow, one finds when the venous flow into the right auricle is increased from 100 to 3,000 c.c. per minute, the outflow increases exactly at the same time, and no damming occurs anywhere. In this case there is very slight increase in coronary flow.

Thus we see the heart has the power *automatically* to maintain its output equal to its intake under a wide variation of volume, to regulate its output independent of blood pressure or valvular

defects, to regulate its own blood supply so that more blood and oxygen are supplied when more work is done, and to assist in regulating blood pressure with, or in spite of, vaso-motor changes.

What is the nature of this automatic regulation? A suggestion as to how this is done is given by a study of the volume of the ventricles and pressure inside the ventricles during variations of arterial pressure and increased venous intake. When more forcible contractions are needed, owing to a rise in aortic pressure, for the first few beats the ventricle does not empty itself, that is, the volume is thereby increased. The same thing happens when increased venous intake occurs. It is found that within physiological limits, the larger the volume the greater are the strength of contraction and the amount of chemical change at each contraction. That is, the strength of contraction is in proportion to the length of the fibre, as in skeletal muscles; or, otherwise stated, an increase of the extent of active muscle surface increases the energy of contraction. Muscular contraction seems to have something to do with surface tension. (Show chart of relation of tension, length and energy.)

This gives us an idea of the nature of dilatation. Whenever the muscle is in difficulty, either from an increase of pressure ahead, or volume to be handled, or from a lessened contractile strength, due to disease or anæmia, it increases its volume; that is, it dilates, because by so doing it increases its strength of contraction, and by so doing maintains an even output. This is the physiological method of overcoming increased pressure or handling larger volumes of blood. A heart does not dilate because pressure from somewhere stretches it. It dilates because it could not maintain the circulation when its volume was normal, but by allowing its volume to increase it is able to put out the required two or three ounces of blood per beat. The heart sometimes remains dilated for months or for over a year before it regains its ability to put out the required amount of blood from a normal sized cavity. In young people extreme dilation of the left ventricle occurs with slight symptoms. Dilatation is a matter of regulation of the degree of relaxation in systole, and is within fairly wide limits a physiological process, and not a matter of being stretched because of weakness. When in difficulty through any cause, dilatation occurs to increase contractile strength. It is an exercise of the function of tonicity. It is a reserve trench.

The power of the undiseased heart muscle to do extra work is so great that it can carry on a sufficient circulation in spite of

almost any valvular defect or increased resistance in the aorta. A normal right ventricle can carry on through life with a congenital pulmonary stenosis, in which the opening is only three sixteenths of an inch in diameter.

Cardiac failure is always myocardial failure, due to myocardial disease. The chief importance of even such serious valvular defects as mitral stenosis, or aortic stenosis, or insufficiency, is that these are the results of long continued disease, either infective or degenerative (arteriosclerotic) in character, which damages the heart muscle at the same time. The same is true of aortitis, whether syphilitic or not. A man with a syphilitic aorta rarely dies of rupture of the aorta. He dies of myocardial weakness of syphilitic origin.

So far the functions of contractility and tonicity have been discussed. There is one sign of failing contractility that should be emphasized, *e.g.*, pulsus alternans, as it may be present when one is in doubt as to the significance of symptoms and physical examination. This is a peculiar action, in that every second contraction is weak though the timing is regular. The weak beat is not premature. This is best detected by taking the blood pressure either by palpation or auscultation. The swing of the needle is less every second beat. When the pressure in the cuff is above systolic and is being lowered, first only the strong beats come through and are heard or felt. Then when the weak ones come through one hears a louder and a weaker thump alternately. It can always be detected by this method, which is available to every physician. One would usually fail to detect it by ordinary palpation of the radial artery, or by auscultation over the heart. It is by most observers considered to mean failing contractility, and when constantly present, death usually occurs within a few months or a year or two.

Irregularity in force at intervals, occurring without irregularity in time, is serious. This happens nearly always just preceding death. It is a still worse manifestation of failing contractility when the force lessens with each inspiration (the so-called "pulsus paradoxus").

Too often in examining a patient a physician takes into consideration only two things, namely: 1st, the presence or absence of valvular disease. If no murmurs are present he says the heart is normal. 2nd. The strength or contractility, judging this largely by the patient's symptoms and the presence of signs of failure with passive congestion. Most of us pass over the other cardiac functions without a thought. Abnormalities of these other func-

tions (*e.g.*, irritability, conductivity and stimulus manufacture) are manifested by irregularities of action. Some of these are unimportant, and others are very important, requiring life-long treatment.

To estimate the importance of irregularities, one must know something of their classification. Nearly all irregularities can be recognized without such special instruments as the polygraph and electrocardiograph. The latter especially is a very valuable instrument, but belongs to a well equipped hospital and requires specialized training to operate. The polygraph can be used by anyone and gives as valuable information in most cases as does the electrocardiograph. It, however, requires time and patience. The scope of this paper is to deal only with clinical methods such as may be employed by everyone without special instruments.

Irritability or excitability, meaning the minimal strength of stimulus required to produce a contraction, has no clinical bearing that is well known at present.

Stimulus formation has a very important place in affecting the efficiency of the heart's action. All heart muscle fibres have the ability to manufacture stimuli and will do so if given time, that is, if not made to contract during the time the impulse is being gotten ready, because contraction destroys or discharges all stimuli that are in the process of manufacture. Otherwise stimuli from various parts of the cardiac muscle would be constantly "butting into" the normal rhythm and regularity would be impossible. Regularity depends on stimuli being formed at one place all the time. The spot that has the impulse ready first, therefore, sets the pace and all the rest of the musculature contracts because of having received an impulse, and at the same time has discharged all partially developed impulses. The pace-maker, as you know, is a bit of specialized muscular tissue believed to be a remnant of the original sinus wall, situated just below the mouth of the superior vena cava in the right auricle, and called the sino-auricular node. From this centre the wave of contraction passes out in all directions and spreads like rings of waves from a pebble dropped into water, being conducted directly from muscle fibre to muscle fibre and not through any special conducting mechanism. When the wave reaches the base of the auricle, it stimulates another similar area, the A.V. node, which is the commencement of a bundle of differentiated muscle fibre, called the bundle, or the bundle of His. This carries the impulse across the septum to the ventricles, either as a wave of contraction, or in a fashion similar to that by which a nervous impulse is carried; probably by the latter method because the im-

pulse travels along the bundle branches five times as fast as it travels directly through ventricular muscle. The bundle divides into two branches, one for each ventricle. These pass as main trunks down the interventricular wall to the base of the papillary muscles and apical region, then turn back up the outer ventricle wall as branches, called the Purkinji fibres. This whole conduction system is situated beneath the endocardium. The whole ventricle goes into contraction more rapidly than the auricle, because the impulse is distributed to it by a conduction system and does not have to depend on muscle conduction. The reason for this is obvious. The ventricular muscle conducts most slowly because its function of conduction is a minor one. It is the driving part of the organ and is provided with a special conduction system designed to produce almost simultaneous contraction of the whole chamber. The papillary muscles contract early, thus closing or at least nearly closing the mitral and tricuspid valves and preventing back-flow. The last portion of the ventricles to be stimulated is the base around the commencement of the aorta and pulmonary arteries, thus tending to have a valvular action and supporting the thin semilunar valve segments so that they do not have to take up the high arterial pressure with a jerk, which they do not appear strong enough to withstand.

There is one more point about conduction that is important. It is the time required for passage of the impulse from the auricle to the ventricle. It is so timed that the papillary muscles and ventricular contraction begins before relaxation of the auricles. Regurtgitation would occur if the auricles relaxed before ventricular systole commenced. Therefore delayed conduction interferes with the efficiency of cardiac action.

Disease of the bundle causes delayed conduction, *i.e.*, "block." When the bundle is diseased it acts as if it were fatigued. First, conduction is delayed. The delay increases till an impulse fails to pass through altogether and the ventricle does not contract. A beat is missed. Then the bundle, having had a period of rest, conducts the next impulse more quickly. After a few beats, again the delay increases and finally stops again. And so the process is repeated. Conduction might still further fail till only every second auricular beat got through, in which case the ventricular rate would be half of what it had been. One often sees this halving in rate in pneumonia charts of patients having large doses of digitalis. One of these degrees of conduction failure or partial block often occurs in acute illnesses, such as pneumonia, or diphtheria, or rheumatic

fever, and is important not because it is likely to increase or become permanent, but because it is a manifestation of myocardial disease, and other parts of the myocardium are likely affected also.

In partial block of any degree the ventricle still responds to stimuli from the auricle. When conduction stops, there is a long pause which might be fatal before the ventricle contracts from a stimulus prepared by itself, usually in some part of the conducting apparatus. Now the ventricle does not get impulses by the bundle from the auricle, and the block is complete, and, as you know, the rate is below 40. This is a very different state of affairs from partial block. In the latter, digitalis is dangerous, delaying conduction. In complete block it is indicated because it improves the function of stimulus manufacture. Two varieties of ventricular stoppages occur in defective conductivity: 1. When conduction ceases before the ventricle takes up its own rhythm, *i.e.*, when partial block becomes complete. 2. During complete block stoppages occur which Lewis showed were not due to failure of contractility, lessened irritability, or absence of conductivity in the ventricle, and are therefore due to failure of stimulus production, which acts as if fatigued and stops for a rest at times. The stoppage is followed by unconsciousness; if it lasts nine to ten seconds, by a convulsion, and if over forty or fifty seconds, by death. The administration of digitalis lessens the length and number of the stoppages in experimental block.

All the cardiac functions are so important that they cannot well be separated. Thus we see that death occurs in block, either partial or complete, not from failure of conduction, but from failure of stimulus production.

The most important and commonest irregularities of cardiac action are due to disturbances of stimulus production. There are two varieties of such disturbances:

A. *Sinus Arrhythmia*: Where the sinus node produces impulses irregularly. When this occurs the irregularity can be recognized by auscultation from the fact that it consists of a regular alternate quickening and slowing of the rate, usually keeping pace with inspiration, which aspirates more blood into the chest and the heart increases its rate to pump it on. This is a sort of hypersensitiveness of the sinus node and occurs in children, and after infectious diseases in adults. It is of no clinical importance except that patients have sometimes been unnecessarily restrained or alarmed by being told their heart was irregular.

B. The second variety is where impulses from abnormal places

produce contractions. Any spot, to produce a response, must get its impulses ready more quickly than the sinus node. No part of normal muscle has this ability; therefore any area that can do this is abnormal muscle. That is about all we can say about the origin of these ectopic beats. Diseased muscle produces them sometimes, and sometimes diseased muscle does not produce them. Their one characteristic, that stamps them as arising from an abnormal spot, is the fact that they come too soon, that is, they are premature. They come before a sinus beat would come.

Varieties of irregularities due to stimuli arising in abnormal places:

1. *Extrasystoles.* This is the commonest of all irregulatities. The name is bad. There is not an extra beat but a premature beat followed by a long pause, as the following sinus or normal stimulus usually does not come into effect, either because the early contraction from somewhere else discharges it, or because it finds the auricle in the refractory period, that is, a period following contraction, during which it cannot receive an impulse. A better name would be premature or ectopic beats. They are commonly wrongly called "missed beats." A real missed beat is partial block. The premature beat may not be felt at the wrist, but it can always be heard by careful auscultation, whereas in partial block nothing is heard for a space equal to the time of two normal beats.

Extrasystoles usually occur irregularly. If an occasional one occurs, or even if they occur often, they are of no clinical importance and need no treatment. In fact there is no treatment for them. Digitalis usually increases their occurrence as it improves stimulus production. Violent exercise usually lessens their number.

They do assume some importance in rare cases when they occur very often and arise at the A.V. node, this causing the auricle and ventricle to contract together.

2. *Bigeminal Pulse.* Sometimes every second beat is premature. This is called a bigeminal pulse, though the second beat may not be felt at all over the radial. Here, two beats followed by a long pause, might simulate the much more serious variety of irregularity, *i. e.*, partial block with every third beat missed. These are easily distinguished by auscultation, as the long pause in the latter is double the space between the two beats, while in a bigeminal pulse the long pause has none of that relationship. It is either more nearly of the same length if the premature beat is late, or else many times the short pause, as usually is the case. The premature beat in the bigeminal pulse is also usually much weaker than the sinus beat.

3. *Trigeminal Pulse.* Where every third beat is premature. This is differentiated from partial block again by auscultation by the fact that the third beat is too early to have arisen from the sinus node. Bigeminal and trigeminal pulses are also not of much importance, except as an indication that the patient is well under the effect of digitalis, if it happens to have been being taken at the time. Digitalis sometimes produces this curious coupling of beats. It is, however, a step up in importance over extrasystoles occurring irregularly.

4. *Paroxysmal Tachycardia.* If one spot can produce a premature beat, it might continue to do so, producing a new and rapid rhythm, beginning suddenly and ending suddenly and lasting any length of time, from a few beats to a few days. Paroxysmal tachycardia is a series of premature beats and originates either in the auricule or ventricule. Its cause is the same as that of extrasystoles. Its importance depends on how long it lasts and how fast it is. Rarely it might become continuous and exhaust the ventricle and cause cardiac failure and death. Most people are incapacitated and have to lie or sit during the attacks. There is no treatment of value for it. Once in a while, simply holding the breath will stop an attack. In paroxysmal tachycardia the rate may be anything over 120. The rhythm is regular. It is usually 140 to 180. I saw one as high as 256. The ventricle is able to respond to each auricular contraction in paroxysmal tachycardia.

5. *Auricular Flutter.* In some cases the auricular rate from the abnormal pace maker is very rapid, 200 to 350. These rapid auricular tachycardias are called auricular flutter. In these the ventricle cannot respond so rapidly. Some beats must of necessity be missed. The ventricular rhythm may assume one of two characters.

1. It may contract regularly, responding continuously to every second or third impulse. If this occurred, one could not detect it by clinical examination.

2. The usual manner of ventricular response is irregular, that is it contracts following perhaps a second, fifth, third, seventh, fourth, etc., auricular beat, in which case there might possibly be an obscure time ratio between apparently completely irregular beats, a ratio of two to five, etc. This is exceptional on account of varying conduction time. The rapidity of the ventricular rate in flutter depends on the bundle. The better the conduction, the faster the rate (up to 180). A certain degree of block protects the ventricle from receiving so many impulses.

The treatment consists in producing a sufficient grade of block with digitalis to keep the rate below 80.

Flutter is often continuous for years, but many cases are temporary. A great many elderly people with coronary sclerosis have auricular flutter. It is common in mitral stenosis. The polygraph shows the auricular waves better than does the electrocardiograph in some cases.

6. *Auricular Fibrillation.* In this irregularity the auricle does not beat as a whole at all. It is limp, and small isolated contractions are occurring all over. No contraction spreads far as it meets areas already contracting. The theory of its origin is that all auricular fibres are initiating impulses rapidly. Certainly impulses are arising all over continuously. Another theory is that the contraction does not sweep over the auricle normally on account of deficient conductivity. The latter is not very reasonable, as fibrillation can be begun instantly in a normal auricle by stimulating it with a weak farradic current. A fraction of a second previously conduction was perfect. A part of the auricle, or one auricle, cannot fibrillate alone. Both must fibrillate. If an auricle is nearly cut in two with only a small bridge of tissue connecting one piece with the remainder, and one side of the auricle is made to fibrillate, the process passes over the narrow bridge of tissue to the other part of the auricle, until the connecting bridge is about three sixteenths of an inch. Over a narrower strip than this fibrillation will not pass. The bundle of His is narrower than this, therefore fibrillation never passes over to the ventricles, or of course death would result at once.

Fibrillation occurs most often in mitral stenosis, but why it occurs in some and not others is impossible to tell. MacKenzie says that 80 or 90 per cent. of cases of cardiac failure with œdema have fibrillation. This figure is too high for Toronto About half of the cases of failure with œdema have it.

It is recognized clinically by the character of the pulse which is irregular both in time and force, and rapid—100 to 140—unless the conduction is poor, due either to digitalis influence or bundle disease. In it, it has been estimated that about 600 impulses a a minute are showered on the A.V. node. Clinically one cannot distinguish between fibrillation and flutter when the latter is completely irregular unless one can see, as one can occasionally, the rapid waves in the jugular vein due to rapid auricular contractions. The irregularity is not quite so gross in flutter; especially in a radial tracing can one see many beats of the same length as if the ventricle

had responded to the same number of auricular beats successively for a few times.

For treatment there is no need to distinguish them, as the same treatment is indicated for both, *e.g.*, to protect the ventricle from a shower of impulses by blocking most of them with digitalis, that is, give enough of this drug to keep the rate below 80.

Cases with fibrillation or flutter, having failure, are the most favourable to treat as, though one cannot change the auricle's action, one can protect the ventricle from having to contract 100—140—180 times a minute and this improve both the general and the coronary circulation and the functional capacity of the heart muscle.

Fibrillation is a little more serious than flutter. It is usually permanent and is a great added burden to an already diseased muscle.

To conclude, abnormal function depends on a diseased muscle. When can we say that myocardial disease is present?

1. Obviously in failure of either type, that with passive congestion and œdema and that with angina or cardiac asthma.
2. When it is enlarged.
3. Nearly, but not quite always, when aortic stenosis or insufficiency or mitral stenosis is present, or mitral insufficiency with enlargement. The amount of enlargement is usually a rough indication of the amount of disease.
4. When auricular fibrillation or flutter, or any grade of block or pulsus alternans is present.
5. When the aorta is dilated or aneurysm is present.
6. When pericarditis or adherent pericardium are present.

NOTE.—This paper is a review of current ideas of cardiac function and such authorities as Starling, Sir James MacKenzie and Thomas Lewis are freely quoted.

KALA AZAR

By Percy C. Leslie

Changteho, China

THIS disease obtained the name by which it is generally known from the natives of Assam, among whom it has long been known in epidemic form with high mortality. Known also and perhaps more correctly as Leishmaniasis, kala azar (black sickness) has numerous synonyms, as tropical splenomegaly, burdwan fever, dum dum fever, etc.

As defined by Manson: Kala azar is an infective disease, characterized by chronicity, irregular fever, enlargement of spleen and liver, the presence of the Leishman-Donovan body in these and other organs, emaciation, anæmia, frequently a peculiar hyperpigmentation of the skin and a high mortality.

For many years kala azar was confused with other diseases, being variously described as ankylostomiasis, Malta fever, but especially as a malignant and chronic form of malaria; the enlarged spleen being regarded as symptomatic of malarial cachexia. It was Rogers of India, following up the work of Leishman and Donovan, who concluded that the parasite now commonly known as the Leishman Donovan body was constantly present in the spleen and other organs of patients suffering from kala azar, and was undoubtedly the cause of this disease.

Attention was first drawn to kala azar by the devastation wrought by it in Assam, in the foothills of the Himalayas where, as far back as 1869, "black sickness" was regarded by government medical officers as an important factor in the high death rate, families and even villages being decimated by its widespread ravages. Occurring in certain villages for a number of years it would gradually lose its virulence and eventually die out—unless the population died first—thereafter appearing in neighbouring villages. To kala azar has been ascribed decrease in population of as much as 24 per cent. in certain districts covering a period of ten years, instead of the normal increase of 10 per cent.

As found in other parts of India, Ceylon, Northern Africa, Arabia, and China, kala azar is more frequently endemic and

follows a more chronic course and of lessened virulence, while recovery with immunity against subsequent attacks does occasionally occur, the mortality where reliable statistics are available, is always high, reaching 90 to 95 per cent. Sex and age appear to offer no barrier although some observers regard children as much more frequently attacked, and in our own series of cases in China children were almost invariably the sufferers. Some claim the existence of a distinct infantile variety, but while in some districts children may be more frequently infected, the disease must be regarding as one affecting all ages.

Symptoms. After an indefinite period of incubation, as short as ten days but probably much longer as a rule, fever sets in, which may be by initial chill and at first range from 103° to 104°, dropping in one or two weeks to 101° to 102°, or according to some the temperature may even reach normal and a period of apyrexia set in; this again is followed by one or more acute pyrexial periods, until eventually the fever reaches a more chronic form and does not usually rise above 102°.

The pyrexia is of remittent type but the characteristic feature is the diurnal rise of temperature, the chart showing a remission between the two high points; while this feature prevails in a large percentage of cases we hesitate to assert that it is an invariable symptom, indeed some of our own cases did not show this type of diurnal rise. Fever persists for weeks, or in some cases months or years, until recovery takes place, or as usually occurs, death intervenes.

Beyond a slight acceleration of pulse rate, no special cardiovascular changes have been noted.

Anæmia. With accompanying weakness, anæmia is frequently the first symptom which draws attention to the disease, either by patient himself or his friends, the condition gradually developing and progressing, the patients, usually of countries with deeply pigmented skin, take on a dusky hue, unlike other anæmias, either primary or secondary. The anæmia rarely reaches the extreme that is present in some other diseases and the hæmoglobin is diminished in much the same proportion as the red corpuscles are reduced; it being always remembered that patients living almost exclusively on vegetable diet have not the high degree of hæmoglobin present as in our own meat eating race.

The characteristic feature of the blood is the pronounced leucopænia that invariably occurs, the white corpuscles reaching as low a level as 1,000 per c.mm. and as related to reds are reduced to

a relationship of 1-1,500 or 2,000, some cases being 1-4,000. There is marked relative increase in the mononuclear leucocytes, especially of the large cell variety, a condition common to all protozoal infections. The red cells while reduced, are rarely found to be less than 2,500,000 per c.mm., and in many well developed cases more than 3,000,000

The spleen. One of and sometimes the outstanding symptom of kala azar is the enlargement of the spleen, giving the familiar pot belly appearance; early in the disease the spleen can be felt below the costal margin, and as the disease progresses the enlargement extends to level of navel or even to crest of ilium, and reaching well beyond the medium line, the organ is hard and resisting to the feel and there is considerable tenderness on pressure. As seen post mortem the trabeculæ are enlarged, the pulp increased and full of blood, the section showing under the microscope a profusion of parasitic growth in the crowds of mononuclear cells.

The liver, also enlarged, never shows the extreme hypertrophy that characterizes the spleen, but in well marked cases reaches two or three fingers breadth below the costal margin.

The lymphatic glands are enlarged and in well pronounced cases are readily palpable in the cervical and inguinal regions.

Other changes as seen in the post-mortem room are in the bone marrow which becomes very vascular and is laden with the infecting parasite.

Diagnosis. The general symptoms together with the blood changes are, after eliminating malaria, sufficient to render a provisional diagnosis of kala azar, but this is only made definite by the finding of the Leishman-Donovan body in the blood or infected organs. This parasite, classified as a herpetomonad, has occasionally been isolated in the peripheral blood stream, but when this is done it is usually after a long and tedious search, the spleen affording the most convenient and the most reliable source of diagnosis. By means of a small sized exploring needle attached to a syringe, a small quantity of spleen tissue is removed and expressed on to prepared microscopic slides, a smear, similar to ordinary blood smear is secured and the specimen left to dry; water and moisture must be eliminated in procuring the specimen and the slide must be absolutely dry, the needle may be dried over a spirit flame and the skin rendered antiseptic by use of tincture of iodine. Alternative sources of diagnosis are offered by the liver, in which the parasites are almost invariably found but in diminished numbers, also by removal of an enlarged gland from cervical or inguinal regions, the gland is cut across with a dry scapel and the

raw surface smeared on to miscrocopic slide. This latter method has been advocated by Cochrane of China, owing to the hæmorrhage which very occasionally follows spleen puncture; some practice a button hole incision down to the spleen and then puncturing, in this way accidental hæmorrhage can be immediately dealt with.

Isolated from the human host and stained by Romanowsky's method the Leishman-Donovan body appears free as a small oval-shaped organism about the size of a blood plate, faintly blue with violet staining nucleus and micronucleus, the former round or oval is sometimes centrally placed but is also seen near the periphery, the micronucleus very deeply staining is rod shaped and lies at right angles to the nucleus or at a tangent, giving a very characteristic appearance by which the parasite is recognized. While almost invariably appearing free in the specimen, the parasites occasionally are found in leucocytes. While in body of invaded host, the parasites live in the endothelial cells in which, after maturing, they disrupt and appear free until the young invade other cells or are occasionally ingested by leucocytes. Recently cultures have been grown and development followed as well as in body of bed bug: these investigations show growth in size, flagellation, fission of nuclei, then of parasite. Inoculation of lower animals has failed to reproduce the disease.

Mode of Infection. The all important question as to method of invading the human host still remains unsettled. The bedbug has been under suspicion for a long time, but although growth and development in its body has been demonstrated, the method, if any, by which the bug infects man is still unknown; nor has any intermediate form of development been observed, such as occurs in the life history of malarial parasite in the mosquito.

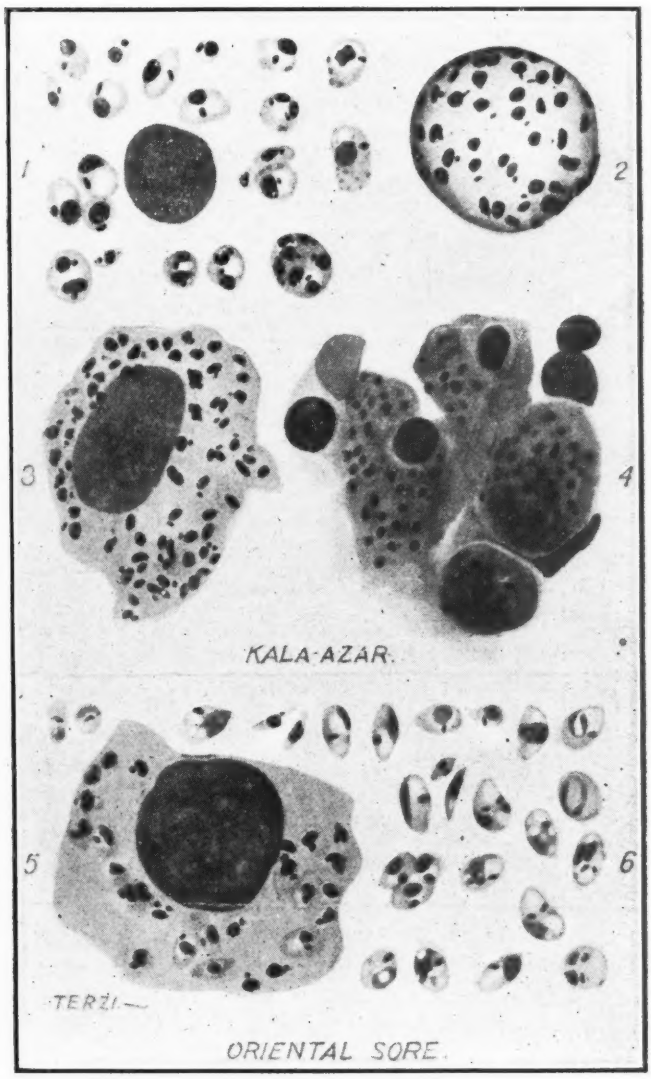
Prophylaxis. While ætiology is still obscure, prophylaxis must remain unsatisfactory. Nevertheless where measures of isolation and segregation could be carried out, great success in stemming the spread of the disease has followed. Experience has shown that kala azar is eminently a household disease, and in India by isolating all infected persons, destroying the villages in which kala azar was epidemic and moving the well population to a newly constructed village nearby, few if any new cases occurred. Further, in the Indian tea gardens, where the disease was rampant, newly arrived coolies who were segregated in newly constructed huts within a few hundred yards of old huts where numerous cases existed, remained free from the disease. Rogers is of the opinion that absence of infected bedbugs is the explanation of immunity in the new and sanitary hutments.

Treatment until recently has been experimental and unsatisfactory. Quinine in large doses has been recommended in early cases, but has little if any effect in staying progress. Arsenical preparation have been tried and discarded. Splenectomy has had its advocates—also its victims; cures reported, have in some cases we know of, had relapses and death ensued. It is difficult to see how the removal of spleen can effect cure in a disease which invades the entire glandular apparatus and bone marrow; such heroic measures, at best could hardly obtain a general following, and would be limited to a few expert operators and a few carefully selected cases. An antitoxin of staphylococci has had advocates and reported cures, but the latest form of treatment, and that which promises most satisfactory results, is tartar emetic, administered intravenously: 2 to 10 c.c. of a 1 per cent. solution is introduced every few days, in increasing doses, this is kept up until symptoms disappear, spleen recedes, temperature and blood are restored to normal. To ensure permanency of cure, patient must be kept under observation for weeks or months after symptoms clear up, in order to guard against recurrences. While tartar emetic has been very effective in treating kala azar, it is a little premature to claim that we have in this drug a specific remedy.

Oriental Sore. This chronic benign ulcer is known to exist in many countries where kala azar thrives and great interest is attached to finding in the scrapings from the score, organisms identical to the Leishman-Donovan body as found in kala azar. Beginning as a pruritic spot, shotty to the touch, the sore goes through the papular stage and later an open ulcer follows, the edges clean cut with a brownish exudate filming over the surface, and induration of surrounding tissue. The "sore" runs a course of months or a year but recovery is the rule. While autoinoculation take place and occasionally relapses occur, subsequent recurrences of the sore are unknown; not only so but Oriental sore is claimed to render patient immune from kala azar and vice versa, while treatment by tartar emetic is just as effective or more so.

Dogs and camels are both subject to infection by Oriental sore and it is quite probable that flies or other vermin may carry the Leishman-Donovan bodies, and either by bite to unbroke skin or by settling on some abrasion, infect the human host.

The analogies between these two widely differing clinical conditions are of great interest and may yet afford important knowledge of the epidemiology of kala azar and mode of transmission of the infecting organisms.



PARASITE OF KALA AZAR

1, free forms from the spleen; 2 and 3, in the endothelial cells; 4, in the liver

PARASITE OF ORIENTAL SORE

5, in endothelial cell; 6, free forms

THE ANTI-TUBERCULOSIS CAMPAIGN—A SOCIAL CAMPAIGN—THE ROLE OF THE GOVERNMENT—THE ROLE OF PRIVATE EFFORT

By Eugene Grenier, M.D.

Montreal

THE nature of the anti-tuberculosis fight is somewhat like human nature in general; it hardly changes. I may quote not inappropriately the works of Dr. Boureille, of Paris, at the Washington Congress. "Let us realize," he said "that the anti-tuberculosis struggle is a struggle of the general interest against private interest. It is the struggle of fifty tenants in a flat of six stories against their proprietor; the struggle of two hundred workmen in a factory against the boss; the struggle of a hundred thousand inhabitants of a town which is badly lighted, badly cleaned, against their municipality; the struggle of one part of a nation which is miserably fed and miserably housed, against another part of the country which is more fortunate; the struggle of those possessing nothing and directing nothing, against those who possess and direct."

The anti-tuberculosis fight is therefore a social fight. In this sense it will have no chance of success except in so far as public authority and private initiative work in concord and each in its own sphere. In this age when everybody talks bravely about his right, and very little about his duties, I think it is particularly useful to try to define exactly what the masses in this campaign against tuberculosis expect from the people.

People understand that it is the province of its representatives freely elected, whether to the Federal, Provincial or Municipal Government, to make laws. In order to preserve the health of the well, and to restore the health of the sick, the people need and demand such laws as will limit the work done by the pregnant woman, prohibit child labour, fix the age at which the young man and the young woman may be allowed to sell their time and their

strength, stipulate the average number of hours which workmen and workwomen may give. The people is assured that it has a right to expect that its breathing air shall be free of the opaque, acrid, and dirty smoke of factories and locomotives, as well as of the clouds of dust in streets which are not watered or in antiquated workshops. The people knows that it has a right to healthy living conditions; it demands protection in the matter of the quality of its food, and it expects also food at a price that will enable it to buy the quantity necessary for the preservation of its strength. These conditions are nothing more than simple rights to which individuals generally have a perfect claim. Briefly it means a healthy life based upon the three great principles of hygiene —adequate rest, good air, and good food. And we, the people, must never forget that a government can only carry out plans that are practical and useful on condition that its work of administration keeps a due regard for the existing political system. While the privilege of making laws is not only the finest and noblest, but also the most necessary of the functions of a government, it is at the same time the most difficult in execution. Capital and labour, the employer and the employee, instead of each having their professional back-stairs politician working to get passed legislative measures which favour exclusively the opposed interests of one side or the other, ought to unite in assisting the passage of laws whose aim is to secure for the whole population the due amount of rest and recreation, of good air and of good food. It is the right of public authority to expect from its people such support and such co-operation.

Why therefore the hesitation in this matter which is obvious to all of us? I am fully aware that laws must not be either hard or oppressive; none the less must they be efficacious; and that means a whole train not only of sanctions but of penalties. But with the infliction of penalties, public authority always comes under suspicion. In the public mind to be instructed and educated is splendid, but to be chastised, never!

At this point in the argument, public authority thinks that private initiative should enter and play a part. For private initiative can instruct and educate without law making and without threats of punishment. Possessing no warrant of arrest, it can yet teach the proprietor to increase the number of his windows, the factory owner to ventilate and drain his factory better; public carriers to keep their conveyances clean and prevent overcrowding. It can go to the workman and teach him to keep his dwelling place

open to the sun and hygienic, and to choose in his food-buying things that are nourishing and substantial. It can solicit from the press, from teachers, from priests, and from employers the means of spreading among the people the proper teaching of the elementary facts of physiology and hygiene. In a word, it can open the mind of the crowd, it can prepare the mental attitude of the masses, not merely to accept without murmuring, but even to demand from public authority the erection and the maintenance of hospitals or sanatoria, without which any successful anti-tuberculosis struggle is impossible.

Such institutions require large sums of money. The experience of the last twenty years has proved that only the Government is able to stand the expense of construction and of upkeep. From the money point of view public authority in the anti-tuberculosis struggle is the interested party, and private initiative, even from the point of view of tact, must always take care not to dispossess public authority of its right, or rather its duty, of making the major contribution to the work. If on occasion private initiative thinks it opportune to donate large sums of money, such an act will surely be regarded by the Government as a proof of friendly co-operation; as a good and useful example.

Furthermore, it belongs to the domain of private initiative to educate the people up to the idea of always respecting the official representatives of the Government in their work, while it also carefully fosters an enlightened public opinion. Only in this way can we protect from incompetence in public servants. It is also the only efficacious means of preventing that autocratic spirit which seems to enter in and possess nearly everybody who once puts on the uniform of a Government official.

Let private initiative, therefore endeavour to form a sound and reasonable public opinion. I say reasonable, because the public, often without knowing it, easily becomes and often is, as a matter of fact, autocratic. We have to avoid both official and public autocracy if we are to secure the intelligent and humitarian co-operation of efforts between the Government and all classes of the nation.

But these efforts must be directed, controlled, co-ordinated; must all tend towards a common end, and this control, if it is to be efficacious, must come from a central authority and must refer to it. This central authority in Canada must clearly be the Federal Government. It goes without saying that the provinces, towns, and even villages may, indeed ought to have, their local organizations. But just as in the Army, these last should receive their

instructions from the federal authority, and must render an account to it. One might very well, in the question of central control of the anti-tuberculosis struggle, adopt the line of action practised in the granting of the federal medical license. In each province we possess doctors, public minded citizens, artisans, and politicians who are well acquainted with the details of the campaign against tuberculosis, and the federal authority could very profitably listen to their advice in establishing the general plan of campaign and in carrying it out. Their co-operation, working in the provincial units and all the numerous local organizations, resulting thus in a very wide and combined effort, would be very valuable in securing first, for all social classes in the nation, the inalienable rights of the people to proper rest, pure air, and good food; and secondly for the sick, especially the tuberculous sick, that treatment, both early and correct, and that environment which experience has shown to be necessary.

A PAPER ON SHOCK

By Dr. J. W. Richardson, F.R.C.S.

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THE subject of shock is so broad, so important, and so much discussed that I enter upon it with many apologies and certain misgivings. It may be said of me that "fools rush in where angels fear to tread". This paper is not written with the view of giving my own views on the subject, if I have any, but is a partial compilation of some of the recent writings of which there are volumes at the present day.

It is not my intention to discuss shell shock, which is really a misnomer, and in a goodly number of cases might be more correctly designated by the term neuræsthenia or hypochondria due to abnormal environment. I desire to refer particularly to surgical shock as seen frequently during the late war and not infrequently in private practice. There is still considerable confusion between surgical shock, physical shock and shock due to hæmorrhage. This probably in part accounts for the conflicting views as to ætiology and treatment.

Many authors have given us definitions of surgical shock. The one given by J. E. Sweet of the University of Pennsylvania seems to me to be the most concise as well as comprehensive, that is, "that shock is a condition marked by gradual and progressive fall of blood pressure with no obvious cause such as hæmorrhage, alteration of intracranial pressure, or heart failure."

In order now to form some idea of the causes of lowered pressure it will be necessary to recall some of the factors which enter into blood pressure. These might be stated as follows:

1. The inherent elasticity of the blood vessels due to the elastic fibres in their walls.

2. Tone of the involuntary muscle fibres, especially those found in the walls of the small arteries and arterioles.

3. Some causes of this tone, such as nerve impulses and the presence in the blood of secretions from certain of the internal

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glands, or possibly some toxins, which in one way or another have found their way there.

4. The amount of blood in the vessels, which depends on amount of inflow and outflow, and this of course depends on the rate of the heart-beat and the amount of blood forced out of the heart at each systole.

5. The viscosity of the blood.

6. The vaso-motor centres.

7. Last but not least what is known as hydrostatic pressure, that is pressure due to the specific gravity of the blood itself. We now see that a disturbance of any one of these factors may cause a difference in the blood pressure. It naturally follows that the differences of opinion regarding the causes of shock and its treatment are many. Henderson, who is a physiologist and whose chief interest is in the blood-gases and the final exchange of gases between tissue and blood, dwells on the importance of the exciting effect of carbon dioxide on the vaso-motor centres. He reasons that an increase in the amount of carbon dioxide in the blood increases blood-pressure on account of its stimulating the vaso-motor centre. Therefore, he reasons if the carbon dioxide in the blood becomes below normal (a condition known as acapnia), we would have lower blood pressure and shock.

This writer leads us on from acapnia to hydrogen-ion concentration, alteration in alkaline reserve, acidosis and to depths beyond, where those who are not physiologists are unable to follow.

We shall now come to some experimental work done by Guthrie of Pittsburg. This work is both interesting and instructive. Without mentioning the technique in carrying out his experiments, I will just mention some of the things done and the results obtained.

He tied the portal vein and arteries supplying the alimentary canal and liver, and was able to produce shock just as easily as if they were not tied. In another animal in which he had produced profound shock he ligated the veins and arteries of the alimentary canal including those of the small and large intestine, stomach, pancreas, and spleen. He removed these and estimated the amount of blood in them. It was found that this was not above normal amount.

He made still another test. He tied the portal vein and arteries supplying the alimentary canal and liver and then elevated the posterior trunk of the animal. This produced a marked rise of blood pressure. This rise was practically the same whether

vessels were ligated or not. These findings tend to disprove the theory that shock causes a bleeding into the splanchnic area.

This experimenter administered carbon dioxide by inhalation in profound shock, but could see no change in the animal's condition. On the other hand the adminstration of adrenalin in salt solution administered intravenously, promptly increased the blood pressure and improved the action of the bulbar centres. He suggests that gradual and prolonged adminstration of the drug would offer advantages over intermittent injections, in that recovery of cerebral function is more successful with a more evenly maintained arterial pressure, than in the case of intermittent injection.

He concludes from the above experiments that a lowered capillary pressure and consequent sluggish return flow of blood to the heart rather than chiefly venous dilation is a more comprehensive view of the condition known as shock.

Sweet concludes, after various experiments (a description of which is too long for a paper of this sort), that shock is a primary failure of the musculature of the arterioles caused by a toxic condition acting on the adrenals. He believes that the secretion of the adrenals acts on the vaso-motor centres and causes tone. This theory would explain the resemblance between psychic and traumatic shock, for the relation between fear and anger and the adrenals is capable of experimental proof.

Without burdening you with further description of experimental work on this subject, I will conclude this part of my paper by giving you the conclusions arrived at by Cannon, who has made a thorough investigation of shock during the recent war. In brief he states that shock is due to a diminution in the normal alkalinity of the blood caused not only by deficient oxidation but also more than probably by the absorption of acid substances produced by catalysis (chemical breaking down) of injured muscle tissue. Anything which contributes to deficient oxidation such as loss of red corpuscles (hæmorrhage) or the reduction of body heat, increases acidosis and consequently shock. As shock produces cardiac weakness and lowering of blood pressure (resulting in sluggish circulation and therefore insufficient oxidation) a vicious circle is quickly established, and the patient is doomed unless the chain is broken into.

This leads us to the question of treatment. It has been found that if external heat be applied to the body, shock may be prevented or even arrested. If the alkalinity of the blood is already diminished fresh normal blood should be supplied by transfusion in

order to restore the alkalinity and increase the blood pressure and supply oxygen carriers. In this way a patient may be so improved that crushed or torn tissues if present can be removed, which if left might bring about a condition of increased shock.

In order that transfusion may be satisfactory we must consider the blood of both donor and recipient. The donor should be if possible a near relative. His blood should be tested with the recipient's with a view to elimination, hæmolysis, and agglutination. Under no consideration should a transfusion be given until these tests have been made.

The citrate method seems to be the most popular way of transfusion. I shall not go into details of this method for they can be found in almost any reliable text-book on the subject.

External heat should be applied to the body. The head should be lowered and the most valuable stimulant would seem to be adrenalin administered slowly and intravenously.

PHYSICAL EXAMINATION OF THE CHEST

By D. A. Craig

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IN order to in any way approach accuracy in physical examination the most intense concentration is required. Undivided attention must be given to the patient and the task in hand. Once the examiner has begun to wander he is lost in a maze of uncertainty and doubt and sound judgement becomes impossible. There is, moreover, a frequent tendency to become biased in opinion by suggestive appearances which may lead to hasty and erroneous decision. He who constantly tends to base his diagnosis upon individual outstanding features of the case, or upon indefinite signs propounded by some enthusiastic observer, is sure to be an erratic and unreliable clinician.

At the present time we are fortunate in having many very valuable aids to physical examination. The *x*-ray and the laboratory have come to occupy an important place. They are, however, and always must remain, secondary to the diagnostic skill of the physician himself. They can never replace that aptness born of repeated experience; that individuality of the perceptive senses and that sound judgement which becomes the greatest asset of the trained clinician. One does not wish to in any way detract from the tribute due those recent scientific developments which have become such valuable assistants in our work. It would, however, be a catastrophe, were they allowed to take the place of personal judgement on the part of the physician. These valuable assets may be of the greatest assistance but they cannot replace the trained special senses.

There is a strong personal factor in chest examination, but upon certain general principles we all must work and base our conclusions. Single examinations are never satisfactory in doubtful cases. It may be necessary to see the patient upon several occasions and at different times of the day. A hurried, tired, overworked physician is not capable of giving a sound statement of the chest findings in his patient. There is a tendency, particularly in the diagnosis of early tubercle, to place too much stress upon

examination of the chest. The symptoms in these cases are usually the most striking, if carefully noted. The clinical thermometer and the scales tell us of things which we can neither see not hear. Physical signs in tuberculosis indicate the damage already accomplished. Symptoms indicate what is going on.

In examining a pulmonary case one must endeavour to form a mental picture of the actual condition, pathological or otherwise, present in the thoracic viscera. Inspection should be made anteriorly, laterally, posteriorly, and from above downward over the shoulder. This procedure having been carried out, it may be found of advantage to sit at the side of the patient rather than directly in front of him and to examine one entire lung, front and back, before proceeding to the other. If the patient places his hand upon his head, one then has a clear sweep of the lower lobes and the bases exposed for examination. One great advantage of this method is that, should the patient cough, he cannot scatter spray directly in the face of the examiner.

In inspection of the thorax, besides the respiratory movements, retractions or bulgings, Litten's sign, etc., the position and nature of the apex impulse gives one very valuable information as to the existing state of the thoracic contents. Displacement of the apex beat may be intrinsic or extrinsic. Intrinsic displacements are the result of pathological conditions within the heart or pericardium. Extrinsic displacements are the result of crowding or pulling from accumulations of fluid, neoplasms, aneruisms, or fibroid retractions.

In the truly incipient case of tuberculosis, inspection and palpitation may reveal little evidence. Percussion is thought by some observers to hold first place, but upon auscultation most of us must largely depend. Sir Robert Philip of Edinburgh has emphasized the narrowing of the resonant suspender band over the shoulder, in early apical infiltration. Rivière, basing his observations on Abram's lung reflex of contraction phenomena, calls attention to certain bands of dulness on percussion which are not due to density of underlying lung tissue caused by disease. If a heavy percussion is made just below the clavicle in a healthy chest, impairment of the note of light percussion will occur most marked near the point of concussion and spread over the chest wall, particular bands of dulness being noted posteriorly. It is claimed these bands of dulness may be detected in early tuberculosis before signs appear on ausculation. They are explained as due to vague stimulation caused by the inflammatory irritation of

the lung parenchyma. Rivière says that these dull areas may be readily found in children, and are of value not only in early diagnosis, but in determination of the results of treatment and the prognosis in any given case.

Limitation of motion, retraction, increased vocal fremitus, a high pitched note of dulness on percussion, are, as a rule, indications of more or less alteration in the consistency of lung substance, and therefore presuppose pathological changes which can be accomplished only in considerable time and by acute disease.

Fine râles heard at the termination of inspiration bear, however, the chief place in the findings of early tubercle. They are usually first located at one or other apex, the right most frequently, in the supra-spinous or supra-clavicular fossæ. Extension occurs downward below the clavicle and either inward in a crescentic margin along the sternal border, or outward into the axilla. The apices of the lower lobes behind and the inter-lobar fissures should receive very careful attention. An approximate guide to this area may be had by having the patient place his hand well over the opposite shoulder, when the vertebral border of his scapula will indicate the area required.

The râles of early tuberculosis as a rule cannot be heard during ordinary respiration, or even when the patient breathes deeply. These are made discernible only by having the patient cough. The râles may then be heard either during the cough or n the inspiratory phase following. The best results are accomplished by having the patient cough toward the termination of expiration. The ordinary reflex cough occurs at the height of inspiration, and is too loud and explosive in type to be very useful in auscultation. The patient should, however, not be allowed to hold his breath following the cough. He is not so apt to do this if he coughs during the latter part of the expiratory phase. In this procedure a sudden positive pressure is produced which opens out collapsed alveoli and bronchioles in distant areas and reveals signs hitherto obscure. When asked to cough, the patient should always be made to hold a gauze or paper handkerchief before the nose and mouth, using the hand on the side away from the examiner. The head should also be turned slightly away, but one must avoid putting the muscles upon the stretch as they are apt to produce confusing sounds. In cases of recent hæmoptysis, acute pleurisy, severe laryngeal ulceration or an acute abdomen, the patient should certainly not be asked to cough. The râles brought out by cough have been termed "latent", and have been emphasized many

observers (Bray). Certainly no one has made a thorough auscultatory examination of the chest who has not asked his patient to cough.

Roughened or cogwheel breathing, whether well-marked or distant, is a sign which must not be lightly regarded. Occurring on both sides and over a fairly extensive area, it may be the result of nervousness or muscular action, but unilateral cogwheel breathing has a pathological cause. Patients who are suffering from dry pleurisy will frequently breathe in a restrained manner, which may be mistaken. Much emphasis has been placed upon this sign by Turban and others. The roughness may be due to three local factors; tuberculous infiltration,—and hence the roughening of the walls of the finer bronchioles,—accumulation of sticky secretion in the bronchioles, or interference with the elasticity of the lung substance. Should the roughness be due to accumulation of secretion it may disappear after cough, but otherwise it is constant. In cases where roughened breathing is followed after a time by the development of alveolar râles, it is possible that there has been an early infiltration in the fine bronchioles extending later to the air cells. Localized areas of persistent roughened breathing, particularly at the apices, should always be given extremely careful consideration.

The transmission of the whispered voice through infiltrated lung tissue was emphasized by Flint many years ago. It is a sign which is easily distinguished by the auscultator. The sound heard when the bell of the stethoscope is placed over the larynx and the patient asked to whisper, is similar to that heard over the chest in the presence of certain pathological changes. The whisper is an intensified and punctuated expiration. In the normal chest it is heard as a distant blowing, and sometimes not at all. Apical intensification of the whispered voice, particularly at the left, is an indication of diminished air capacity, probably due to compression or infiltration. Apical compression may be the result of involvement of the lung substance itself, or of other factors of extrinsic nature, such as an enlarged thyroid or aneurism. At the apices and over the upper parts of the lower lobes behind, one most frequently finds this sign clearly marked, though scattered areas of intensified whisper may be found over any part of the chest. The whisper may bring out the presence of beginning consolidation before other things, such as blowing breathing or dulness on percussion, can be elicited. In this regard auscultation of the whispered voice in the axilla may be of great assistance in early pneumonia.

Special attention was drawn to this by McCallum of London during the epidemic of influenza and pneumonia last winter.

The use of sound production is one of the most important factors in chest examination. If the equilibrium of an elastic body is disturbed, certain vibrations are set up by means of an attempt on the part of that body to regain its original state. The slower of these vibrations are perceptible to touch (tactile fremitus), the more rapid to hearing. As the bow sets the violin string in vibration, so the movement of air through the respiratory passages sets the tissues in motion. The rapidity of the air current controls the amplitude of the vibration in the tissues and the intensity of the sound produced.

The lung itself acts as a load upon the vibrations set up in the chest. If the lung tissues are relaxed, as they are above fluid, the load is reduced, hence the area becomes more tympanitic (Skoda's resonance).

To intensify sound artificially we use resonators. These are sympathetic vibrators. The thorax itself is to a certain extent a resonator, but in close proximity lies the stomach, which, in a distended state, acts as an intensifier of sound. Within the thorax, pulmonary cavities or pneumothorax act as intensifiers, and upon this fact we base our findings for the diagnosis of these conditions. Small cavities may cease to be resonators and consequently escape detection; this may occur when they are deep seated, or when their communication with the bronchi is partially or totally closed, or their cavity is filled with exudate.

The voice and breath sounds produced in the larynx and upper respiratory passages are called upper respiratory sounds. They are carried downward through the trachea and bronchi into the pulmonary tissues, being modified by distance and the density of the tissues.

Diffusion and reflection play an important part in the modification of sounds wave as they pass through the lung substance and the chest wall. Vibrations spread outward from a point of greatest intensity and gradually lose their force or vibratory energy. Moreover, as they come in contact with substances of different densities, they are thrown back or reflected.

An analysis of the different phases of the respiratory act is required in order to interpret competently the nature and variation of the sounds produced. A good orchestra leader can pick out the different parts of the orchestra although all are playing. A good chest examiner must be able to pick out the different phases of the

respiratory act and make a separate analysis of each. Too frequently indeed we attempt to listen to the whole respiration at once. There are certain transmitted sounds which are frequently confusing to the auscultator. These may be produced by swallowing, by muscular tension or joint movements. Most of them may be eliminated by proper instruction of the patient.

One cannot attempt in one paper to discuss the usual physical signs found in each pathological condition. There are always great variations and many factors influencing the case.

When all is said and done, it is not the method of the examiner, but the manner in which he interprets his findings which counts. Does he read in the signs elicited the existing condition, pathological or otherwise, in the patient's chest? When we consider the work of such men as Auenbrugger, who first introduced the art of percussion, and the great Lænnec, with his auscultatory findings and stethoscope, and farther back still, the wonderful writings of Hippocrates and Galen, we must stand in reverence of their genius as we, with all our scientific researches, have not added so much to what they had already given us.

Conclusions

1. Sound transmission plays an important part in physical examination of the chest.

2. The cough following the expiratory phase is necessary in careful chest examination.

3. One should concentrate upon the different phases of the respiratory act and make separate analysis of each.

4. The *x*-ray and the laboratory are very valuable assistants in physical examination, but cannot replace the skill of the physician.

5. Individual signs are not to be relied upon.

6. The chest examination, no matter how thorough, is only a partial examination of the patient.

WATER SUPPLIES IN QUEBEC

By T. J. Lafreniere, M.D.

Montreal

QUEBEC has a population of 2,380,000 inhabitants distributed as follows:

18 cities	Pop. 1,101,200
81 towns	178,400
220 villages	158,400
887 rural municipalities	942,000

The urban population, *i.e.*, the population of the cities and towns is 53·7 per cent. of the total population and the rural population is 46·3 per cent.

There are four hundred and forty water supplies in the province, but half of them are very small, in some cases serving only a few houses. It is difficult to determine the exact population served by waterworks; however, according to the data available, 59 per cent. of the population of the province is supplied by such works, while the remaining 41 per cent. derives its water mostly from private wells.

The writer has made a special study of the water supplies in the cities, towns and villages with a population of more than five hundred inhabitants. There are two hundred and thirty such municipalities and one hundred and ninety-two of them, with a combined population of 1,383,700, have waterworks. It is interesting to note how the various sources of supply have been utilized.

Sources of Water Supplies in Quebec

Source	No. of Works	Per cent. of total number	Population	Per cent. of total population
Rivers	97	50·5	1,192,512	86·2
Lakes	20	10·4	52,879	3·8
Springs or wells	75	39·1	138,338	10·0
Total	192	100·0	1,383,729	100·0

Read at the fiftieth annual meeting of The Association, Quebec, June, 1919.

Eighty-six per cent. of this population is supplied with river water, a very high percentage. This is due to the fact, that with the exception of four, all the cities use river water. When the waterworks were installed, some forty years ago, the rivers were fairly clean, and the necessity of pure water was not as well understood as it is to-day. The towns were built on the shores of large rivers offering a supply of good appearance, and consequently the rivers were used in preference to more distant sources of supply.

The lakes, on the other hand, have not been fully utilized, when you consider that only 3·8 per cent. of the population is supplied by such a source. The numerous lakes all over the province offer a first class supply; unfortunately, the lakes are not near the large centres of population. Twenty waterworks use lake-water, but they serve mostly small towns.

The water-bearing formations in the province are not well known, the available information on the subject is very meagre. Hence, 10 per cent. only of the population is supplied with underground water. With few exceptions, the seventy-five waterworks in this class use springs originating at the outcrop of a porous stratum underlain by an impervious one. Such supplies are usually possible for small towns only. Several artesian wells have been sunk in the last few years, with remarkable success; the disadvantage of this source of suppy is, that unless an extensive water-bearing formation is known to exist, the yield of the wells is uncertain, and the possibile variations are great.

A great number of municipalities do not own their water supply, but with the exception of a part of the city of Montreal and two adjoining cities, this occurs in small towns and villages only.

Ownership of Water Supplies in Quebec

Ownership	No. of Works	Per cent. of total number	Population	Per cent. of total population
Municipal	124	64·6	1,046,260	75·6
Private	68	35·4	337,469	24·4
Total	192	100·0	1,383,729	100·0

One municipality out of three does not own its water supply. The cost of waterworks is high, and after the construction of the same, the small town finds that most of its borrowing power has

been used by the waterworks, and that practically nothing is left for other improvements. Consequently, in order to have both the wate works and the necessary funds for other improvements, the municipality gives a franchise for the waterworks, which is a revenue producing utility. This practice is not to be encouraged, as in most cases, the system does not provide for adequate fire protection, and eventually, the municipality has to buy the system and practically build it anew. Towns should be allowed to borrow for waterworks purposes without decreasing their borrowing power, enough revenue being provided by proper by-laws, to pay the cost of operation of the works and the sinking fund.

If we examine the use made of the various sources of supplies by the municipal or private corporations, we find that in both cases, over 85 per cent. of the population is supplied with river water. Two private waterworks only use lake waters, while forty small supplies are derived from springs and wells.

MUNICIPAL WATERWORKS

Source of Supply	No. of Works	Per cent. of total	Population	Per cent. of total population
Rivers	71	57.3	903,778	86.4
Lakes	18	14.5	49,929	4.8
Springs and wells	35	28.2	92,523	8.8
Total	124	100.0	1,046,260	100.0

PRIVATE WATERWORKS

Source of Supply	No. of Works	Per cent. of total number	Population	Per cent. of total population
Rivers	26	38.2	288,734	85.5
Lakes	2	3.0	2,950	0.9
Springs and wells	40	58.8	45,745	13.6
Total	68	100.0	337,469	100.0

We have seen that 86 per cent. of the population served by waterworks is supplied with river water, which is usually unsafe for domestic use. However, all of this water is not consumed without previous treatment. In the province to-day, 858,000

people are supplied with filtered river water, and 170,000 with chlorinated water, giving a total of 1,028,000 people using treated water. This number represents 86 per cent. of the population using river water. Six municipalities, with a population of 60,000 people, now chlorinating their supply, have been ordered by the Superior Board of Health to install purification works.

Lake water and underground water being naturally good, it would seem that our water question is practically solved; unhappily, it is not so. The great percentage of the population is protected against waterborne diseases, but the remaining 14 per cent. is divided among many small municipalities which will be harder to reach than the larger towns.

The Quebec Public Health Act gives to the Superior Board of Health extensive powers concerning the control of water supplies. All new waterworks have to be approved by the Board before being installed. Furthermore, the Board has the right to make investigations and to order purification works where needed, or to order the causes of pollution to be removed. When the supply is owned by a private corporation, the Quebec Public Utilities' Commission decides whether the improvements shall be paid by the private corporation or the municipality served by the supply.

To comply with the orders of the Board, the municipal corporation is allowed to borrow the necessary amount without being obliged to submit the by-law to its ratepayers, and the Board has the right to have the improvements done at the expense of municipality, when the latter refused to comply with the orders of the Board.

The installation of water purification works is a great improvement, but no benefit wil be derived from it unless the works are operated properly. The large cities can afford expert supervision, but the small town would find it quite expensive. In order to obtain the best possible results from such works, the Board, through its officers, gives a certain amount of supervision.

A new method of daily sampling the water, devised recently by the laboratory of the Board, will enable the Board to control more effectively the operation of the purification works, where there is no local laboratory. The method consists in sending by mail, daily water samples, which are examined for the presence of B. Coli. Any decrease in the efficiency of the plant may be thus detected and remedied before any harm is done. The method has been very successful, so far, and the cost to the municipality using it is about $1,000 a year.

ON THE TAKING AND EXAMINATION OF THROAT CULTURES

By A. Howard MacCordick

THE purpose of this short paper is not to deal with the bacteriology of the nose and throat as a whole, but more particularly with the conditions existing in or simulating true diphtheria.

The bacteriology of the throat and upper air passages is, of course, almost unlimited. Exclusive of infection by wounds and the manifestations of venereal disease, perhaps every germ, pathogenic and non-pathogenic, that enters the system, enters through the mouth or nose, and the number of bacteria entering the body daily by these routes must be enormous. Our food alone contains unlimited bacteria and the number inhaled from dust during a dry windy day in spring or autumn must be equally vast.

When we realize that most bacteria will live from several days to several weeks or more on fruit and vegetables, or in mud and dust during dark cold weather, we have full assurance that many of the organisms which we swallow or inhale are alive and viable, and ever ready to set up disease when placed in a favourable environment.

A few organisms such as the bacillus of typhoid fever and its allied group, do not as far as we know, affect the mouth, nose or throat pathologically. Others apparently affect only the throat. Such, for example, are the organisms of Vincent's angina. But the majority of the bacteria which infect the nose and throat may also produce local involvement elsewhere or generalized septicæmic infections, such as the pneumococcus, tubercle bacillus, meningococcus, or even the diphtheria bacillus itself; and in those diseases of which the bacteriology is still indefinite, such as scarlet fever, measles, whooping cough, infantile paralysis, etc., we have many reasons for believing that the invading organisms, be what they may, first establish themselves in the mucous membrane of the upper air passages. It is necessary, therefore, that in our examination of throat swabs for diphtheria we should pay more attention, in the case of a negative finding for diphtheria, to these other possible

infections, and a bacteriologist's report which merely states "no diphtheria" cannot be regarded as completely satisfactory.

While the majority of throat cultures are made merely to demonstrate or exclude the presence of the diphtheria bacillus, it would seen very desirable to note the presence or absence of four possible infections.

1. True diphtheria.
2. Acute follicular tonsilitis, so called, due to the presence of a streptococcus or pneumococcus.
3. Vincent's angina.
4. A mixture of any two or all three.

Only with a correct knowledge of the infection present can proper treatment be given and a fairly accurate prognosis be made.

As regards the appearance of the throat clinically, we first have the greyish, firmly adherent patch of membrane with possibly a characteristic odour, which to the trained eye and nose, and on consideration of the accompanying clinical symptoms, appears to be definite diphtheria. Then we have the sharply defined, rounded, punched out ulcer, the floor of which is covered with a greyish, easily detached membrane, which leaves a bleeding surface; a condition which is almost as easily labelled, "Vincent's angina". Again we have the enlarged and reddened tonsils with numerous small patches of exudate, which we at once call acute follicular tonsillitis, But between these are conditions of all sorts, and appearances which it would seen can not be diagnosed accurately without the aid of the laboratory. And just here should not be overlooked the frequent occurrence of mucous patches in secondary syphilis in which cases the spirochæte pallida can be easily demonstrated by the aid of the dark stage illuminator.

For the taking of nose and throat cultures, the ordinary sterilized tube and swab are the most convenient, and just as serviceable as any of the more elaborate appliances. In this connection the importance of having a strong applicator should be emphasized in order that sufficient force may be applied in rubbing the surface of the lesion. The end of the swabs should be forcibly rubbed into the membrane or under its edge, in the case where it is firmly adherent, or if the membrane is not firmly adherent, enough force should be applied to rub it off and deposit it on the swab. The reason for this is that often throat cultures come to the laboratory, direct smears from which show typical Klebs-Loeffler bacilli, but the cultures show very few or none, simply because only the outer surface of the membrane was swabbed, and that lightly. In such

cases it is very difficult for a bacteriologist to give a proper report to the doctor in charge of the patient, and unless direct smears are made in all cases and studied carefully, there is no doubt many cases of diphtheria will be overlooked.

The taking of nasal cultures is even more easily accomplished than those from the pharynx, simply by tipping the end of the nose upward and inserting the swab horizontally.

In taking cultures in acute conditions, no preparation of the patient is necessary. If, on the other hand, cultures are required in conditions such as whooping-cough, chronic catarrhal conditions, or in cases of suspected diphtheria or meningococcus carriers, the patient if old enough, should be instructed to gargle the throat with boiled normal saline, and snuff the same solution through the nostrils every hour for four or five hours, previously to the cultures being taken. The mucosa then, if rubbed firmly, will yield the suspected organisms if present.

Having obtained the swab from the nose or throat, a direct smear on a sterilized glass slide, should always be prepared before making the culture, not only because the swabbing may not have been done sufficiently, providing it be a case of diphtheria, but because the condition may be one of Vincent's angina, in which latter case the diagnosis must be made on the direct smear alone since the organisms do not grow on ordinary culture media, and it is very necessary to know if they are present. Again the infection may be a mixed one of diphtheria and Vincent's. In which case, if a direct smear be not made and the spirochæte found, it may be difficult to understand why the throat is so long in clearing up, even after the repeated administration of antitoxin. In some cases, while clinically the throat appears to be one of acute follicular tonsillitis, still in both direct smears and cultures may be found a mixture of pneumococci or streptococci, and also what are morphologically, at all events, typical Klebb-Loeffler bacilli. Without cultures, many such conditions would be judged as merely, septic, and while they are by no means clinically or bacteriologically true diphtheria, it is a question as to whether these organisms, in the absence of antitoxin, can produce a subsequent myocarditis or neuritis.

Personally I believe that where organisms resembling the diphtheria bacillus are found, a prophylactic dose of antitoxin, at all events, should be given.

The records of the Western Hospital, and the Drummond Military Hospital for the past five years, and the cases in which

cultures were taken on admission to the Alexandra Hospital during the past year, show a total of three thousand cases, exclusive of those taken in the case of soldiers in whom the meningcococcus was suspected. Of these: Definite Klebs-Loeffler bacilli were found in nine hundred cases, or in 30 per cent.; the spirochæte of Vincent's angina was found in two hundred and four cases, a percentage of 6·8; both the bacillus of diphtheria and the organism of Vincent's angina were found in sixty-one cases, or a percentage of about 2. Questionable diphtheria bacilli and septic organisms were found in one hundred and one cases, or in 3 per cent. In the remaining 1,266 cases the bacteriological examination failed to reveal the presence of either diphtheria bacillus or the spirochæte of Vincent's angina, a percentage of 42.

It may be stated here, however, that a number of these cultures were sent, accompanied by a note from the doctor, to the effect that clinically the condition was not one of true diphtheria, but it was desirable to definitely exclude that condition, a precaution which is indeed a very wise one. It is important to note, however, that while 1,470 of these 3,000 cultures did not show the diphtheria organisms, the throats were sufficiently suspicious, clinically, to warrant the request for a bacteriological examination. The question then arises, how many cases there are of true diphtheria, the objective signs of which are not sufficiently typical to warrant the taking of cultures, and yet these same cases may be almost as dangerous to the patient himself and just as dangerous to a second person, as cases of clinically, typical diphtheria.

It would seem, then, that for the proper diagnosis of all acute throat conditions, and for the welfare of all persons in contact with such patients, throat swabs should be taken in every case and studied both by direct smear and culture; and in all cases in which malignant organisms have been found, the throat should be proven by cultures to be free from the organisms before the patient is pronounced well. A patient should not only be clinically well, but also microscopically free from infecting organisms before he is allowed to mingle with others.

Case Reports

BICHLORIDE OF MERCURY POISONING BY VAGINAL APPLICATION

By E. V. Frederick, M.D.

Peterborough, Ontario

ON the reques of a physician interested in this subject I report this case.

I was called to see Mrs. ——, age twenty-eight years, suffering from several abdominal colic which had lasted several hours. The temperature and pulse were normal, tongue clean, no abdominal rigidity or tenderness or distention, no diarrhœa.

I did not do a vaginal examination but made a diagnosis of intestinal colic. As I was leaving the room, a neighbour woman said to the patient, Mrs. ——, tell the doctor everything. This made me think that there was more to the case than I had found out, so I went back and made a vaginal examination. In the posterior fornix I found a sticky mass, white and chalk-like in consistency.

Then she told me that menstruation not having appeared on time, she desired to use a douche with some antiseptic tablets she had, but finding her syringe broken she had inserted the tablet itself as high in the vagina as possible.

I immediately gave a copious douche and while doing this she took a clonic convulsion. This was relieved by chloroform. In the next few hours she took several similiar spells.

The next day there was a complete anuria. She was kept in continuous hot packs and given magnesium sulphate purgation. At the end of four days, urine execretion had returned to about half normal quantity with considerable albumen.

Hot packs were decreased to three a day. One week later a severe spell of menorrhagia set in and she became intensely anæmic. Up to this time she appeared almost normal, but from that time she seemed to undergo a molecular or cellular death. The mind was clear but it seemed as if she were decomposing while still living. The odour from the body was nauseating, greyish pallor increased and at the end of about two and a half weeks from the onset she died.

Editorial

ON THE CAUSES AND DEFINITION OF CANCER

IN an interesting article under the above title Dr. Leo Loeb, in the *American Journal of the Medical Sciences* for June, 1920, summarizes as briefly as possible our knowledge of the causes of cancer. He enumerates the following factors which he considers to be generally recognized as entering into the causation of cancer: (1) External stimulation, mechanical or chemical; (2) Internal stimulation, through the action of internal secretions; (3) Heredity, including various not well defined factors; (4) Embryonal disturbances in development; (5) Age, which may enter in an indirect way; and (6) possibly micro-organisms.

Observations on cancer in the human and in the lower animals have abundantly proved the significance of long continued irritation, and in some cases of even a single trauma in the origin of cancer. On the basis of prolonged observation the following conclusions have been drawn: (1) There appears to exist a graded series of transitions from normal growth energy, and cell motility to the increased growth energy and motility of cancer. (2) While it is probable that the transition from normal to cancerous tissues represents a series of stages, the transition from one stage to another may be abrupt. The cancerous tissue may differ sharply from the precancerous tissue morphologically and biologically. It is, however, possible that a continuous but not visible change precedes this abrupt transition. (3) The earlier the stage in the transformation leading to cancer, the greater the tendency to a retrogression which can be produced experimentally. Early stages also yield more readily to the action of agencies which tend to destroy them.

Loeb considers also that experimental investigations demonstrate that the effect of hormones on the development of cancer is a specific one. A hormone influences the development of cancer only in those organs to which under normal conditions it has a specific relation. Such is the influence of the ovary on the development of cancer in the breast. He adds that "it follows from his experiments that attempts to cure cancer of the breast after it has once been established cannot be successful". Loeb also considers that experiments have established the fact that nursing and pregnancy have in general only a negligible influence on the frequency with which mammary cancer develops in mice.

It is commonly assumed that heredity plays no part in the origin of cancer in man. Nevertheless, experiments in mice would indicate that, while the hereditary tendency to cancer does not follow the laws of the simple mendelian inheritance of mono-hybrid characters, it may be explained according to these laws if we assume the presence of multiple hereditary factors. The tendency in mice does not consist in a tendency of the animal to develop cancer indiscriminately in any part of the body, but only in particular organs. In man, however, Loeb considers that changes in the mode of living and the intermarriage of different families may affect the result. It is, however, a well established fact that various conditions which predispose to cancer are hereditary; e.g. pigmented hair. Taking all things into consideration Loeb considers that heredity does have some influence in the development of cancer but its influence is not great, and depends on different factors, regarding which our knowledge is not yet definite. They appear, however, to exist in the presence or absence of chemical or mechanical growth stimuli which originate within the organism, and which, while in themselves are seldom able to induce cancer, do so if combined with other growth-promoting factors.

Again, the embryonal character of tissue, or disturbances of embryonal development play an essentially predisposing

rôle in the origin of cancer. They provide a substratum which has a greater tendency to proliferate and is more receptive to any abnormal growth stimuli which may reach it from any source.

The relation between the age of the individual and the frequency of cancer is not as simple as it often is assumed to be. Cancer may appear in young individuals. This is especially the case in cancer arising from the transformation of embryonal tissue. In some cases, however, the latency of these tumours may be considerable. The age curve of frequency differs also in different kinds of cancer. The arguments which speak against the influence of micro-organisms as a factor in the development of cancer are for the most part convincing. Nevertheless, it is possible that while in the majority of cancers often repeated stimulation of tissues has led to a permanent increase in the intensity of the metabolic processes which cause cell proliferation and cell movements, in certain sarcomata a similar effect may be produced through a constantly acting extraneous chemical growth stimulus produced by micro-organisms. All factors which in various ways either by chemical or physical means increase the proliferative energy of cells may act as causes of cancer. The factors are not essentially different from the growth stimuli which lead to regenerative, and what may be termed correlative growth in normal tissues. In addition there appear in some cases to be other factors existent in the cells which make them more responsive to the growth stimuli, providing a sensitization which in normal cells is furnished by sensitizing substances carried to them by other organs. Some of these factors are hereditarily transmitted in a certain graded quantity from generation to generation, while others are variable and extraneous. All these factors have one characteristic in common. They tend to increase the proliferative energy and motility of cells which are specially sensitive but not yet cancerous. Cancer is an abnormality of growth. Primarily it is a disturbance in the equilibrium of the

individual, not through toxins, but through an increased proliferative activity of the cells which is usually associated with an increased motility, which is long continued and often permanent. In the large majority of cases it is due to changes in cell metabolism which have the peculiar property of propagating themselves. In a few cases the same effect may be produced by extraneous causes, such as micro-organisms.

THE profession will be interested to know that there is now a Canadian Society of Anæsthetists having for its aim the promotion of the science, practice and teaching of anæsthesia. This has been incorporated by Letters Patent of the Dominion Government.

Nearly all of the larger hospitals, both here and in the old country, have on their staffs specialists in this field so that the administration of an anæsthetic in them is no longer in the hands of the nurse or the unsupervised house surgeon.

Those who are interested in the new society are invited to communicate with the secretary with respect to membership.

The officers of the society are Doctor Samuel Johnston of Toronto as president, Doctor William Webster of Winnipeg, vice-president, and Doctor Wesley Bourne of Montreal, secretary-treasurer (34 St. Mark St.). The executive committee is composed of Doctor C. H. Bastin of Vancouver, Doctor G. M. Geldert of Ottawa, Doctor W. B. Howell of Montreal, and Doctor Charles LaRocque of Montreal.

An effort is being made to hold the first meeting of the society in conjunction with that of the Clinical Congress of Surgeons in Montreal in October this year. Further notice of this will appear in the Journal.

Correspondence

FAREWELL MESSAGE FROM MAJOR-GENERAL FOTHERINGHAM, C.M.G.

IN connection with the retirement of General Fotheringham from the duties of Director-General of Medical Services, we have received the following communication and we are glad to give it space in our columns.

CORPS ORDERS

By Major-General G. LaF. Foster, C.B.,
Acting Director-General of Medical Services

OTTAWA, ONT., June 28th, 1920

226 SPECIAL ORDER

Major-General J. T. Fotheringham, C.M.G., upon retiring from the duties of Director-General of Medical Services, desires to take leave of all officers, nursing-sisters and other ranks of the medical services, both those who are still serving and those who have been demobilized but who have at any time served under him.

He is deeply sensible of the constant loyalty and high efficiency of the service as a whole, both overseas and in Canada, and of his indebtedness as officer administering the service in Canada to the personnel as a whole.

The memories of the great war, with its priceless opportunities for serving King and Empire and Native Land, will remain an inalienable asset to us all, and particularly the good-will shown by the service and by the profession generally to those who have been carrying the heavy burdens of responsibility for policy and administration, both at this headquarters and in the districts.

R. E. SNELL

Colonel, A.D.M.S. for Acting-D.G.M.S.

Retrospect

ARTERIAL HYPERTENSION

By R. H. M. Hardisty, M.D.

Moschovitz: *A.J.M.S.*, November, 1919.
Allen: *J.A.M.A.*, March 6th, 1920.
Engelbach: *J.A.M.A.*, June 12th, 1920.
Janeway: John Hopkins *Bulletin*, vol. xxvi, October, 1915
Warfield: "Arteriosclerosis and Hypertension". Moseby Co., 1920.

ARTERIAL hypertension, or high blood pressure, has of late years attracted much attention and every medical journal has contributed its quota to the mass of material now available; and yet withal we are to-day far from having a clear idea as to the cause of this much discussed and very important symptom. Renal conditions and arterio-sclerosis have long been regarded as primary factors in its causation and many chronic poisons as lead, gout, nicotine, etc., have also been held responsible, and yet when all these causes have been considered there remains a certain number of cases to which they do not apply, and to which no other cause can be assigned. It is this last group of cases which have caused so much work and speculation.

Recently there has appeared in the journals articles on this subject which are of great interest. Moschovitz, pathologist of the Beth-Israel Hospital, New York, in a carefully written article thinks that arterio-sclerosis and nephritis are the result and not the cause of hypertension. Cases of hypertension may be divided into three classes. (1) Essential without any recognizable cause; (2) Cases associated with arterio-sclerosis; (3) Cases associated with nephritis. Moschovitz thinks, however, that if kidney changes are looked for, post mortem, they will always be found, even if only in a slight degree. His reasons for thinking that chronic nephritis is due to hypertension or to the primary causes underlying the hypertension are: (1) Cases of hypertension may

show clinically all stages from normal to markedly disordered kidney function, and unless the former is treated they pass into the latter. (2) The signs of nephritis may be arrested by the means that restore hypertension to normal, which would not be possible if we were treating a primary progressive anatomical lesion. In conclusion he describes the appearance of a sufferer from hypertension who he says always conforms to an easily recognized type, which is interesting and may be helpful to the practitioner.

Dr. F. M. Allen in another paper read before the American Society for Experimental Pathology attributes this condition to faulty sodium chloride metabolism which view was worked out by the French, but has not been very carefully followed up since. He shows in tabular form the result of treatment of twenty cases. In these cases the chloride content of the plasma was high and when this was reduced by the withholding of salt from the diet there was a corresponding and very definite drop in both the systolic and the diastolic blood pressure. Many of these cases apparently excrete sodium chloride in normal quantities in the urine, but when examined carefully by modern laboratory methods, they will be found to have abnormally high thresholds for chloride excretion, and excretion is only carried out by high concentration of salt in the blood, and consequent high blood pressure.

Hypertension has been studied from another point of view by Englebach of St. Louis, who found among five hundred cases of uncomplicated endocrine disease that nearly 10 per cent. showed high systolic pressure. These cases clinically were suffering from derangement of one or more of the ductless glands and did not embrace any cases suffering from cardiac or renal lesions, or at least if such lesions were present they were of late development. Chronic infections were also excluded. He thinks that this may be the ætiological factor in many of the puzzling cases of high tension without apparent cause, which have been given various names by different writers. He cites details of cases which under treatment with the appropriate gland were greatly benefited, and he considers the prognosis better in these than in the other classes of cases. The cases of essential hypertension, or cases without known ætiology which come to autopsy, show changes in the arterioles, but this change is not confined to the renal arterioles but occurs also in those of the *pancreas, spleen and brain.* This was pointed out by Jores some years ago and both Clifford Albutt and Janeway who have exhaustively studied this subject agree in considering this as quite a different condition from what is clinically termed arterio-sclerosis

in which the large accessible vessels are thickened and tortuous, and in which as they point out the tension may be normal. Albutt states that the change is a sclerosis and is similar to arterio-sclerosis in any other part of the body, but draws attention to the fact that in the contracted kidney with which we so often get associated high tension there are areas of sclerosed kidney tissue side by side with normal, while in the typical kidney of essential hypertension or what he calls hyperpiasia the kidney is uniformly below normal, and is what he calls a "*withered*" kidney. He also describes a senile or decresent type which develops with age and which is frequently not associated with hypertension and which is not dangerous. Janeway, who in 1915 reviewed the work on hypertension up to that time, prefers to call the condition "primary hypertensive cardio-vascular disease". He says that the view that the disease is of renal origin is unwarranted to-day, and that the kidneys in cases of long standing may show the appearance of the primary contracted kidney, but the earlier cases show only definite thickening of the arterioles, which affects the vessels of other organs as well as those of the kidney.

Warfield in the third edition of his book which has been recently published writes, that we must still consider hypertension as one of the causes of arterio-sclerosis as prolonged hypertension produces changes in the arterial walls. . . . He thinks that the contracted arterio-sclerotic kidney which is so often associated hypertension may be primarily due to kidney disease, or may only develop secondarily of the arteries and arterioles. With Clifford Albutt he agrees that the senile decresent type with its markedly thickened and tortuous arteries is often associated with low tension, but that the smooth hard straight arteries, which are met with in cases of hypertension, are the dangerous type.

In spite of the fact that we now have records of a great number of cases in which essential hypertension existed, we are still to-day unable to explain satisfactorily the cause of this condition. That it is a compensatory condition, resembling that of enlargement of the heart is generally recognized, but what the original cause is that makes these secondary processes necessary for the maintenance of the circulation, is not yet known.

The well-known clincal and pathological picture of definite diseases of the kidneys with its associated hypertension, has undoubtedly influenced many observers when dealing with these cases of essential hypertension, especially in the more advanced stages where albumim and hyaline casts are often present in the urine,

but that this large group represents a different disease there can be no doubt. The now easily recognised symptom of hypertension has been responsible for the names "essential hypertension", "hyperpiesia", "primary hypertensive cardio vascular disease", while the names "presclerosis" and "arteriolar sclerosis" are attempts to give the condition a name based on the anatomical findings.

The exact ætiology of this condition is still unknown; whether it is the result of disordered metabolism, of derangement of the ductless glands or of some extrinsic poison, cannot at present be more than guessed at.

THE NATURE AND TREATMENT OF WOUND SHOCK AND ALLIED CONDITIONS

By Fraser B. Gurd, M.D.,

Montreal

1. Reports I to IX of the Special Investigation Committee on Surgical Shock and Allied Conditions. Medical Research Committee, National Health Insurance.
2. Gesell: "Effects of Hæmorrhage and Tissue Abuse." *Amer. Journ. Phys.*, 1919, 47, 491.
3. Cannon: "The Course of Events in Secondary Wound Shock." *Journ. Amer. Med. Assoc.*, 1919, vol. lxiii, 174.
4. Lamson and Keith: "Role of Liver in Acute Polycythæmia." *Journ. Pharm. and Exp. Ther.*, Balt., 1915, 7, 169, and Keith, *Ibid*, 1916, 8, 247.
5. Erlanger and Gasser: "Statistical Study of Treatment of Measured Trauma by Solution of Gum Acacia and Crystalloids." *Amer. Journ. of Phys.*, 1919, 50, 119.

EARLY in 1917 the British Research Committee realized that there was need for an organization to obtain more continuous co-ordination in the field covered by surgical shock and allied conditions, work regarding which was being carried on in several armies at the front and in laboratories in England. In consequence

several surgical workers in France and physiologists most prominently associated with this line of work were invited to form a special investigation committee, which by pooling and circulating the information received from various sources might keep all workers in touch with the general drift of opinion. Their immediate task was to investigate the conditions as met with in the Field Ambulances and Casualty Clearing Stations.

Up to the present time nine reports have been issued by this committee, comprising twenty-four separate contributions. A large number of observers have been employed, chiefly officers attached to the British service, assisted by Professor Cannon of Harvard, and other United States officers. Inasmuch as the committee responsible for the development of this work was in a position to employ whatever men they thought would be of most value in the collection of data, in the performing of experiments, and in the analysis of such observations, their findings must be considered to be of more than ordinary importance. Many of the subjects which have been discussed are by no means completely covered. It is probable that in the near future further reports will be issued by the committee and it is certain that experiments will be carried out by other observers along the lines indicated in these reports.

Several such investigations have already been made. Certain of these will be referred to at the end of this retrospect.

In a contribution by Cannon, Fraser, and Hooper, on alterations in the distribution and characters of the blood it was discovered that as compared with the venous blood the capillary count in cases of shock is higher. "The discrepancy is greater the more profound the shock and not infrequently it is more than 2,000,000 corpuscles per c.mm. Since the venous count is approximately normal, the condition is due to a stagnation of corpuscles in the capillaries. The observations by means of blood counting have been confirmed by hæmatocrit and hæmoglobin determinations."

They state, "continued concentration of the capillary blood for several days after injury accompanies a continued unfavourable clinical condition. Disappearance of the concentration is a signal of improvement. Continued dilution of the blood after the fourth or fifth day is ominous."

Making use of vital red in order to estimate the blood and plasma volume, Keith carried out a series of experiments in order to discover the blood volume changes in wound shock and primary hæmorrhage. It was proved that the dye, which is harmless when injected intravenously in the amounts required, did not pass into

the red corpuscles to any appreciable extent, showing that the dilution was taking place in the plasma only. By an estimation of the dye dilution in the circulating blood by means of a colorimeter it is possible to make an estimation of the total circulating plasma.

Estimated in this way the total blood volume in normal men was found to vary from 1-13 to 1-10·5 of body weight. The dose of the dye given is 3·0 mg. per kilo of body weight. The total blood volume was obtained by determining the relative volume of blood corpuscles and plasma. "Comparative results in the estimation of the red blood corpuscles contained in blood went to show that the hæmatocrit reading was much more accurate than an actual enumeration of the cells in the counting chamber."

On the basis of clinical observation and the degree of blood volume reduction, cases of wound shock were found to fall into three classes or groups. In Group I, although there is marked palor and a record of hæmorrhage, the general condition of the patient is good and he has no distressing symptoms. The pulse rate is increased to 90 or 110 per minute, the systolic pressure remains above 95 mm. of mercury. The blood volume is never below 75 per cent. of the normal. This amount of reduction in blood volume would seem to be the maximum decrease that occurred in this series without giving rise to marked persistent untoward symptoms.

In Group II the patient's general condition is serious. The pulse 120 to 140, the systolic blood pressure usually 70 to 80 mm. of mercury and the pulse pressure lower. The total volume of blood ranges from 65 to 75 per cent.

Group III are dangerously ill. The pulse cannot be felt, the systolic blood pressure is 60 mm. or less. The heart rate is 120 to 160. In certain of these cases the heart rate falls below 100; when this occurs the outcome is almost invariably fatal. The blood volume is below 65 per cent. of the normal, frequently between 50 and 60 per cent.

It is thus seen that when the blood volume is below 75 per cent. the patient shows serious symptoms of shock, when it is below 65 per cent. his condition is critical.

After moderate hæmorrhage without shock the blood volume is rapidly restored. Recovery from wound shock is associated with an increase in blood volume which may take place with or without intravenous infusion of gum-saline solution or of blood. The initial partial restoration of blood mass is due to a large increase

in plasma volume. In certain cases of wound shock the blood vessels are incapable of retaining an adequate amount of fluid in the circulation.

"In pure hæmorrhage of moderate degree the blood volume is almost immediately restored. That this restoration of blood volume may not be entirely due to the addition of fluid in the plasma, but also to a temporary increase in blood corpuscles is suggested by certain cases. The idea of a reservoir of red blood has been the subject of considerable investigation, and Lamson and Keith were able to show that in experimental polycythemia resulting from large doses of epinephrin the great increase in the number of red blood cells depended upon the hepatic circulation remaining intact. These experiments pointed to the liver as a reservoir of red blood cells and suggested that the latter could be washed into the general circulation under certain abnormal conditions. However, this fact remains clear that when hæmorrhage is severe or is accompanied by extensive trauma, as in wound shock, a condition develops in which the normal process of blood volume restoration fails to take place."

In grave cases of shock without hæmorrhage the smaller vessels of the vascular system are unable to retain the adequate amount of fluid. Further knowledge is needed as to the cause of this alteration in the peripheral vessels which appears in many shock-like conditions.

Keith's observations also confirm concentration of the blood, as for instance in one case (M. M.) the hæmatocrit estimation of blood corpuscles have 88 per cent. normal, the blood volume and plasma volume 65 and 70 per cent. respectively.

Cannon carried out an inquiry into the CO_2 carrying capacity of the blood in cases of shock, hæmorrhage, and gas infection. These estimations were made by the Van Slyke apparatus. In general the lower the blood pressure and the more marked the clinical manifestations of shock, the lower the alkaline reserve. In both hæmorrhage and shock the alkaline reserve is lessened although the figures suggest the hæmorrhage alone is not accompanied by as great a reduction as is shock when the blood pressures are equally reduced.

Records made by Cannon showed that with an arterial pressure of 49 mm. Hg. the CO_2 capacity averaged 24 volumes per cent. with a pressure of 59 mm. Hg. the CO_2 was 35 volumes per cent.

Experiments by Gesell (*Am. Journ. Phys.*, 1919, 47, 491) have shown that a fall of blood pressure to 50 mm. Hg. may be

accompanied by a reduction of the rate of flow of the blood to one fifth its normal speed. In consequence the tissues will be supplied with, other things being equal, one-fifth the usual amount of oxygen. Diminution of oxygen supply results in the production of lactic rather than carbonic acid as a tissue metabolite. As the former is non-volatile there occurs a relative exhaustion of plasma bicarbonate.

Observations upon the sugar content of the blood proved that the acidosis is not due to a lack of circulating carbo-hydrate.

There is a striking fall of blood pressure as the result of operation under anæsthesia in cases in which the alkaline reserve is diminished. Nitrous oxide oxygen anæsthesia is followed by less diminution in the alkaline reserve than is ether anæsthesia.

To the reviewer the most interesting trend of these investigations is that which inquires into the question of toxæmia as a factor in shock. As is well known histamine and a number of different degradation products of proteins are capable of producing in animals manifestations of shock, which are in many ways comparable to those of established shock in the human being. In the reports under retrospect histamine shock has been reviewed and analyzed by Dale, Laidlaw and Richards, and the numerous similarities between shock produced by this substance and that occuring in wounded soldiers considered. In histamine shock in the cat it is obvious that there is a loss of circulating fluid and also that there is concentration of blood. They accept as a working hypothesis that under the influence of a large dose of histomine the capillary tone is lost through the body, and that the whole of the potentially available capillary channels become simultaneously patent; that the blood percolates into this net-work of channels as into a sponge. With the rapid diminution of outflow from the tissues into the veins the venous pressure falls, the heart is not filled in diastole, its output rapidly declines and therewith the arterial pressure. Arterial constriction while it delays the fall of pressure in the arteries cuts off only the more effectively the blood in the capillaries from what driving force the depleted heart can furnish.

When shock produced by histamine has lasted for some time the tendency for natural recovery seems to have been lost. If the animal is left to itself without further administration of histamine the condition of the circulation continues to deteriorate.

A series of experiments was carried out by Dale to test the effect of ether anæsthesia and of hæmorrhage in increasing the susceptibility of the cat to histamine shock. It was determined

that in the normal unanæsthetized cat as much as 10·0 mgm. per kilogramme may be slowly administered intravenously with but temporary and mild symptoms as the result. The same cat some days later, after having been kept under ether anæsthesia given by an open mask for two hours, was fatally shocked by the administration of 2 mgm. per kilogramme. A cat kept anæsthetized with nitrous oxid and oxygen can tolerate the infusion of 10 mgm. of histamine per kilogramme with effects little if at all more severe than those produced in the unanæsthetized animal. This is the case even when the anæstheisa is maintained for an hour before the histamine is administered. One such cat on a subsequent day was anæsthetized for an hour with ether after which 2 mgm. of histamine per kilogramme produced fatal shock.

From the jugular vein of a cat 40 per cent. of the calculated blood volume was removed in twenty minutes. Three hours later the animal showed no definite abnormality. Three mgm. per kilogramme of histamine was administered with fatal shock.

Should future experiments prove that established traumatic shock is a toxæmia due to one of the protein degradation products the importance of these observations is obvious.

Numerous observers have noted as pointed out by Sir Cuthbert Wallace, (a) the improvement that follows the removal of a mangled limb; (b) the association between shock and small multiple or single large muscle wounds; (c) the shock-producing nature of operations involving large muscle masses such as amputation at the hip; and the tentative suggestion is offered in Report IX that, established shock may be due to the absorption from the mutilated muscle tissue of a toxic substance.

In order to obtain evidence regarding this point experiments were carried out by Cannon and Bayliss. They found that shock could be induced by subcutaneously crushing the thigh muscles in cats. The same degree of shock as estimated by drop in blood pressure, was noted whether the nerve supply to the injured limb was intact or not. The crushing of the muscles may not be followed by an immediate effect. After about twenty minutes, however, a fall of arterial blood pressure begins, and after about one hour the pressure has usually fallen to 80 or 90 mm. of mercury, or even lower, that is, to the shock level. If after a low pressure has become established in consequence of muscle trauma the blood vessels of the injured leg are tied, pressure may soon begin to rise and may continue until the original pressure is re-established.

In one cat the blood vessels of the leg were tied before the

muscles were smashed and the ligatures left in place for thirty-three minutes after the injury. No drop in blood pressure occurred during this period, but as soon as the blood flow was restored the pressure promptly fell to a low level. As the injured and uninjured extremity were within 10 per cent. of one another in weight the drop in blood pressure was not due to loss of blood into the damaged tissues. "The conclusion appears justified, therefore, that a pressure lowering substances passes from the traumatized region to the rest of the body by way of the circulation."

Treatment of Traumatic Shock

Erlanger and Gasser summarize their treatment of measured trauma with solutions of gum acacia and crystalloids as follows:

"Of animals traumatized by holding the arterial pressure down to 40 mm. Hg. for two hours and fifteen minutes by partially occluding the inferior vena cava—48 per cent. die within forty-eight hours.

When treated with:

(a) 6 per cent. gum in 2 per cent. sodium bicarbonate 12 c.c. per kilo of body weight—45 per cent. die within forty-eight hours.

(b) 25 per cent. gum followed by 5 per cent. sodium bicarbonate, of each 5 c.c. per kilo of body weight—56 per cent. die within forty-eight hours.

(c) 25 per cent. gum followed by 18 per cent. glucose, of each 5 c.c. per kilo of body weight—45 per cent. die within forty-eight hours.

(d) 25 per cent. gum in 18 per cent. glucose, 5 c.c. per kilo of body weight an hour—24 per cent. die within forty-eight hours.

Not only is the death rate increased by treatment (b), but death occurs earlier.

These results are taken to indicate that bicarbonate and the high viscosity of a strong gum solution are somewhat harmful, at least in traumatized animals; that the harmfulness of the strong, viscid gum can be avoided in part through the osmotic action of hypertonic glucose subsequently injected, but not by bicarbonate; and that when the hypertonic gum and the hypertonic glucose are given simultaneously and slowly so as to avoid altogether the period during which the high viscosity of the gum is hampering the circulation, a maximum saving of life can be effected. The beneficial results presumably are due: (a) to the internal transfusion affected by the hypertonic solutions; (b) to the maintenance of the increased blood volume through the colloidal and possibly other

properties of the gum acacia; (c) to the action of the h pertonic solution on the heart and blood vessels; (d) and to the specific action of glucose on nutrition in general and on that of the heart muscle in particular."

Summary

Recent experiments appear to prove that in established shock there occurs in addition to the drop in blood pressure, rapid heart action and other clinical signs.

1. Blood stasis due to opening up of increased volume of capillaries.
2. Blood concentration due to loss of plasma into tissues and blocking of peripheral capillaries with red blood cells.
3. Diminution in the CO_2 carrying capacity of the blood.
4. Increase in the white corpuscle content of the blood.
5. Blood urea and non-protein nitrogen are increased.
6. The body temperature is lowered.

In the treatment of shock the following procedures are of value.

1. The application of heat to the body.
2. The administration of fluids more especially by the intravenous route. Physiologic saline is of less value than hypertonic saline. Alkaline salts are of more value than sodium chloride. Gum acacia solutions are of real value. Glucose is of value; glucose plus gum acacia is of the greatest value as an intravenous injection. Transfusion of whole blood, however, is usually better than any artificial substance.
3. Nitrous-oxide-oxygen anæsthesia is less likely to produce or increase shock than is ether.
4. The use of drugs is of questionable value. Epinephrin and pituitrin are apparently of greater value than other drugs.

Shock is not due to:

1. Exhaustion of the vaso-motor cells.
2. There is no proof that acapnia is a primary factor in the production of shock.
3. Acidosis is not a primary factor in the production of shock.

Established traumatic shock may be due to the production of toxic substances in injured tissues and may be similar in volume to that which follows the injection of protein degradation products or anaphylactic shock. Should their relationship be proven a marked development in our knowledge of the condition will have occurred, as a vast amount of data is available regarding the latter types of shock.

Book Reviews

STANDARD NOMENCLATURE OF DISEASES AND PATHOLOGICAL CONDITIONS, INJURIES, AND POISONINGS FOR THE UNITED STATES. First edition. Government Printing Office, Washington, 1920.

This volume is a valuable contribution to the scientific and statistical side of medicine. The compilers have endeavoured to present a classification of the various diseases, injuries, and poisonings that doubtless will make a wide appeal, and tend to replace the numerous local classifications at present in use at the various hospitals of the United States. The general adoption of a uniform terminology in describing pathological conditions would add much to the value of our medical literature. D. S. L.

THE LINK BETWEEN THE PRACTITIONER AND THE LABORATORY. A Guide to the Practitioner in his Relations with the Pathological Laboratory. By CAVENDISH FLETCHER, M.B., B.S., M.R.C.S., L.R.C.P., director, laboratories of public health, London, and HUGH MCLEAN, B.A., B.C., D.P.H., M.R.C.S., L.R.C.P., assistant pathologist, laboratories of pathology and public health, London. First edition. 91 pages with 7 illustrations. Price 4/6 net. Publishers: H. K. Lewis & Co., Ltd., London, 1920.

The main object of this pock manual is to assist the practitioner in making a more rational use of the laboratory in the diagnosis and treatment of his more difficult cases. The diseases are presented in alphabetical order, and under each disease a short résumé is given of the various tests which may assist in clearing up the diagnosis. The fields of bacteriology and pathology are well covered, but there is a singular lack of reference to the more recent advances in pathological chemistry. However, the book should be of considerable value to those whose time is too much occupied for reference to the larger works on pathology and chemistry.

D. S L.

MILITARY PSYCHIATRY IN PEACE AND WAR. By C. STANFORD READ, M.D., physician Fisherton House Hospital, Salisbury, 168 pages; two charts. Price, 10/6 net. Publishers: H. K. Lewis & Co., Ltd., 136 Gower Street, London, W.C. 1.

Dr. Read, who had an opportunity to observe most of the mental cases which occurred in the British Army, discusses in an excellent manner the different aspects of psychiatry in peace and war. Dr. Read was in charge of "D" Block, Royal Victoria Hospital, Netley, through which all the mental cases from France and England were sent before being definitely placed in the various mental hospitals in England. He discusses the psychology of the soldier before and after enlistment and shows how the cause of practically all cases of psychoses are due to a psychopathic make-up with contributing causes, such as alcohol, fatigue, worry and anxiety. His belief is that the main bulk of the psychoses are psychogenic in origin. Apart from the acute intoxications and those chronic states induced by many years of excessive imbibing, thereby producing a demential condition, he regards alcohol as only a contributory factor, working with and aiding mental conflict He considers that mental conflict is the most important ætiological factor in the production of the war psychoses. He divides the different psychoses into ten classes,—dementia præcox, paranoid states, confusional states, maniac depressive insanity and simple depressed states, mental deficiency, general paresis, alcoholic psychoses, epilepsy and epileptic psychoses, psychoses with organic brain disease and acute infective disease, psychoneurotic disorders. He discusses all these conditions from the ætiological standpoint, course of the disease and treatment, quoting many German, French, American and Canadian authors. He concludes with a discussion of how the recruiting of the civilian population for the army might have been improved with the present day position of British psychiatry. He lays emphasis upon the fact that our medical students must be more thoroughly trained along the lines of neurology and psychiatry in the future and that there must be more out-patient and in-patient institutions for the advice and treatment of psychopathic disorders which are not psychotic or certifiable. He points out the importance which social service must take in the treatment of all forms of mental abnormality.

The book is well written in good English, and the author, as he says, takes no dogmatic stand but freely discusses the different

psychoses from all view points. The book should be read by every physician who is interested in the mental welfare of his patients and the community. S. S. M.

ARTERIOSCLEROSIS AND HYPERTENSION. By LOUIS M. WARFIELD, A.B., M.D., F.A.C.P., formerly professor of clinical medicine, Marquette University Medical School. Third edition, 265 pages with illustrations. Price $4.00. Publishers: C. V. Mosby Company, St. Louis, 1920.

The author states in the preface that in this edition, the chief changes are, that arteriosclerosis is treated as a degeneration resulting from many ill-defined causes, and that the chapter on Blood Pressure has been much expanded; also that new chapters, on cardiac irregularities, and blood pressure in its clinical application have been added.

The first three chapters deal with the anatomy, pathology and physiology of the circulatory system and are well illustrated.

In the chapter on physiology, blood pressure is discussed and the author says, "A sane conception of blood pressure must be disseminated lest we find it discarded altogether." He speaks of the various instruments used in estimating blood pressure, and gives his opinion that for the practitioner, the Tycos or the Faught instrument has certain advantages, which he mentions.

The technique of taking blood pressure, the normal variations and the advantages of the auscultatory method are then discussed. The proper point at which the diastolic pressure should be read is given, and his views backed by the results of experiments on animals.

Hypertension is dealt with at some length, and the fact that it is a compensatory process is insisted upon. Three classes of cases of hypertension are recognized which have different clinical courses of terminations.

The chapter on cardiac irregularities is short, but particularly well illustrated.

Chapter VI. deals with the ætiology of arteriosclerosis and this criticism of the arrangement of the book might be made, that it should have appeared earlier.

Of quite peculiar interest is the chapter on arterio-sclerosis in its relation to life insurance.

In this chapter the author relates his esperiences as an examiner, and the advantages of his special knowledge. Views on

high systolic and high diastolic pressures are discussed and also our need for more exact data.

The book is compact and easy to read, and contains, arranged in such a manner that it can be easily found, all that is at present known of arteriosclerosis and its symptoms.

MODERN ANÆSTHETICS. By J. F. W. SILK, M.D., senior anæsthetist and lecturer on anæsthetics, King's College Hospital. Second edition, 191 pages, with 37 illustrations. Price 7/6 net. Publishers: Edward Arnold, 41 Maddox Street, London, W., 1920.

The purpose for which this work was intended, namely, "To provide a simple guide for the student and practitioner," is well fulfilled in most of its detail. There are, however, certain statements with which the anæsthetist in Canada is unable to agree. Firstly, we do not use mixtures of chloroform and ether—we use them in sequence and separately. Secondly, Dr. Silk's teachings on the subject of nitrous oxide-oxygen anæsthesia are those advocated by us more than ten years ago. He limits the use of these gases to that of short dental and minor surgical operations and his apparatus has long been discarded here. Whereas by the gradual improvements made in their manufacture, there is, by the acid-wash method, an almost absolutely pure nitrous oxide and, by a system of reducing valves in our mechanisms, complete control of the pressure. With these two factors in the hands of the skilled anæsthetist, no matter what the duration of the narcosis required, we have in well chosen and well prepared cases, continuous nitrous oxide-oxygen anæsthesia satisfactory to the surgeon, and this without the addition of ether or chloroform except on rare occasions. Again, there is no mention made of the use of nitrous oxide-oxygen in obstetrics.

His treatment of ether and chloroform anæsthesias is all that can be desired and can be highly recommended, only we dislike the mention of makers' names on illustrations of anæsthetic containers.

W. B.

Books Received

THE following books have been received and the courtesy of the publishers in sending them is duly acknowledged. Reviews will be made from time to time of books selected from those which have been received.

SYMPTOMS IN THE DIAGNOSIS OF DISEASE. By HOBART AMORY HARE, M.D., B.Sc., professor of therapeutics and diagnosis in the Jefferson Medical College of Philadelphia. Eighth edition, thoroughly revised. 562 pages with illustrations. Price, $6.00. Publishers: Lea & Febiger, 706 Sansom Street, Philadelphia, 1920.

PRINCIPLES OF HUMAN PHYSIOLOGY. By ERNEST H. STARLING, M.D., Hon. Sc.D., Jodrell, professor of physiology in University College, London. The chapter on the Sense Organ revised and largely rewritten by H. HARTRIDGE, M.A., M.B. Third edition. 1315 pages with 579 illustrations. Price $7.50. Publishers: Lea & Febiger, 706 Sansom Street, Philadelphia, 1920.

A TEXT-BOOK OF DERMATOLOGY. By J. DARIER, physician to the Hotel Saint-Louis. Authorized translation from the second French edition. Edited with notes by S. POLLITZER, New York, ex-president of the American Dermatological Association,769 pages illustrated with 204 engravings and 4 coloured plates. Price $8.50. Publishers: Lea & Febiger, 706 Sansom Street, Philadelphia, 1920.

SURGICAL SHOCK AND THE SHOCKLESS OPERATION THROUGH ANOCI-ASSOCIATION. By GEORGE W. CRILE, M.D., professor of surgery, School of Medicine, Western Reserve University, Cleveland; and WILLIAM E. LOWER, M.D., associate professor of genito-urinary surgery, School of Medicine, Western Reserve University, Cleveland. Second edition of "Anoci-Association," thoroughly revised and rewritten. 272 pages with 75 illustrations. Publishers: W. B. Saunders Company, Philadelphia and London, 1920. Canadian Agents: The J. F. Hartz Co., Toronto. Price, $5.00 net.

PUBLIC HEALTH LABORATORY WORK (CHEMISTRY). By HENRY R. KENWOOD, C.M.G., M.B., F.R.S., D.P.H., F.C.S., Chadwick professor of hygiene and public health, University of London. Seventh edition with illustrations. 420 pages. Price 15/- net. Publishers: H. K. Lewis & Co., Ltd., 136 Gower Street, London, W. 1, 1920.

A TEST-BOOK OF PHYSIOLOGY. For Students and Practitioners of Medicine. By RUSSELL BURTON-OPITZ, S.M., M.D., PH.D., associate professor of physiology, Columbia University, 1185 pages with 538 illustrations. Price, $7.50. Publishers: W. B. Saunders Company, Philadelphia and London, 1920.

BACKWATERS OF LETHE (Some Anæsthetic Notions). By G. A. H. BARTON, M.D., anæsthetist to the Hampstead General and Royal National Orthopædic Hospitals, London. Price, 5/- net. Publishers: H. K. Lewis & Co., 136 Gower Street, London, W. 1, 1920.

Medical Societies

SYMPOSIUM ON PATHOLOGICAL SPECIMENS FROM FRANCE, CANADIAN ARMY MEDICAL SERVICES, THROUGH THE PATHOLOGICAL MUSEUM McGILL UNIVERSITY

1. GAS POISONING—Phosgene and Mustard. By Dr. C. S. Peters.

On the night of August 8th, 1916, I started from our headquarters near Poperinghe, to visit the aid posts and dressing stations for which the 9th Canadian Field Ambulance was responsible. You know that all visits to the front were made at night as the Germans

This symposium was held by permission of the Director-General of Medical Services, before the Montreal Medico-Chirurgical Society on Friday evening, November 7th, 1919.

held all the heights at the apex and sides of the salient. The signs that night read "gas alert on". After visiting the posts beyond Ypres I called at the Asylum, which was a large building, then much destroyed, situated on the western outskirts of the city. We had there a section of the unit under Major A. T. Bazin acting as a collecting post or advanced dressing station. The officers and men were comfortably quartered in the cellars and had ample space for their work. A section of the 87th British Field Ambulance occupied cellars in the same building.

Shortly after arriving there the gongs sounded. The drift gas was sent over in three waves at intervals of twenty minutes. Fortunately no infantry attack developed. As soon as the "all clear" was sounded I started for headquarters and I do not think I was ever so glad to get out of a place, but felt sorry to have to leave the others behind.

Early the following morning Major Bazin reported that the British Division on our left had many gas casualties, which commenced to arrive at the Asylum soon after midnignt. He and his men assisted the British Ambulance. I quote from his report: "After inspection in the station the patients were removed to the open air and distributed through the garden and treatment carried out. From the beginning it was seen that there were two types of cases. The one was restless, cyanosed, with a constant strangling cough and a desire to sit up. Pulse rapid and bounding, respiration rapid and deep, extraordinary muscles called into play, body covered with a profuse cold sweat and for an hour or more there would be but scant frothy expectoration, stained a bright yellow. Gradually expectoration would become more profuse, amounting in some cases to from 10 to 20 ounces. It appeared as if the cases in which profuse expectoration came on early, had the better prognosis. The treatment adopted first was the regulation one of inhalation of spirits of ammonia, and quiet. Later, when deaths began to occur all about us with alarming frequency, the following procedures were tried:

(a) Venesection,
(b) Venseection and intravenous saline.
(c) Inhalations of oxygen.
(d) Subcutaneous injections of oxygen gas.
(e) Posturing of patient in the hope of keeping one lung drained.

Death was due to asphyxiation. Consciousness was retained to within a few minutes of death. These were probably mixed, or chlorine cases.

The second class of patients were quiet, pallid, ashy-grey, very little cough, pulse small, rapid and feeble, voice low but natural. Respirations sighing, muscles flaccid, and a feeling of utter exhaustion, occasional vomiting. Treatment was stimulation, in spite of which may died within three hours. In many instances attempts to move or rise caused instant death. These were considered to be the phosgene cases.

Immediately on receiving the report of Major Bazin I went to the 3rd Casualty Clearing Station at Remi Siding and the sight there will live in my memory as long as memory lasts. I have seen many large battle fields and casualties numbering several thousands in a day, but nothing so terrible as the sight in those casualty clearing stations. The patients were in tents with the sides removed, or in the open lying in beds or stretchers, the pallid anxious face, the awful air hunger, the rapid shallow breathing, the restlessness, the coughing, the vomiting, and the groaning, together with the acute consciousness and the anxious appealing eyes, made one feel that the deepest hell is not deep enough for the men who first used gas. No treatment for the severe cases seemed to afford any relief, temporary or permanent.

In 1917 casualties began to occur from a new kind of gas which later proved to be mustard gas, or dichlorethylsulphide. This gas was sent over to us in shells. A shell would fall and burst with only a small concussion, making a hole about one and a half feet in diameter and a few inches deep. In the day time they were readily avoided as they were easily recognized by the big burst of a yellow cloud in the air. At night time they were hard to identify as they were invariably mixed up in a bombardment of ordinary shells. This gas was not nearly so fatal as phosgene, only about 2 per cent. of cases died some days later of bronchopneumonia. It was, however, a very serious cause of casualties. It caused a chemical burn especially in the presence of moisture; hence the eyes, mucous membranes, axillæ and genitalia were chiefly affected. The symptoms appeared rapidly, first vomiting, then burning of the eyes, and the eyes would become markedly swollen so that the lids had to be forcibly raised to obtain a view of them. Serum would squirt from the pressed-open lids in a stream. Photophobia was intense. The respiratory system was much affected, as shown by hoarseness and severe attacks of coughing. The skin lesions varied from a mild erythema to a severe burn with large bullæ. A brownish pigmentation often came on at once and persisted for days. The vapourized gas would lie about on the ground for days and many were burnt from sitting on it.

Mustard gas cases gave the Medical Services at the front a great deal of extra work. All patients had to be stripped and bathed in soda solution, and fresh clothes put on. Besides which the attendants had to use special care to avoid being burnt.

Dr. Peters then exhibited his specimens.

2. Lesions of the Fundus of the Eye. By Dr. S. Hanford McKee.

Dr. McKee showed five slides from a series taken overseas, drawn by one of the men of his unit by the direct method with the ophthalmoscope, the slides being photographs from the original drawings.

3. Injuries and Infections of Joints. By Dr. A. T. Bazin.

The wonderful advance made during the war in the successful treatment of wounds and infections of the joints is due in my opinion,

1. To the recognition of the difference between contamination and infection;

2. To the early mechanical cleansing of the joints, removing all foreign material and all devitalized tissue, including blood clot, and

3. To the complete closure of the joint in layers.

In other words, a "primary suture" of the wound of the joint. This procedure prevented, in the majority of cases, the development of a severe infection which was the cause of death in all those who did not succumb to hæmorrhage or shock in the first few hours after wounding.

Where infection did become established and threatened life, limb, or function of the joint, these were in increasing numbers conserved by:

1. Avoidance of all irritating mechanical drains to the interior of the joint;

2. Early mobilization.

Inasmuch as the knee joint, by reason of frequency and seriousness of resulting disability, formed the most important group of war injuries of joints, the specimens which I show to-night are almost entirely of that joint. Naturally the specimens fall into two classes:

1. Those in which the effects of injury alone are seen, death

being due to, or amputation demanded by, factors other than the joint injury.

I have here two joints, an elbow and a knee (Nos. W.O.C. 2950). This man had multiple wounds all on the right side of the body. He died of systemic streptococcus infection on the eighth day and the prepared specimens show no evidence of the ravages of infection.

2. Those in which the effects of injury, plus infection, present themselves. In this latter class the most extreme damage from infection is found. In less severe infections the specimens are fortunately not available.

In examining these specimens one is at once impressed by the serious complicating injury to bone. If one has to deal with injury to the joint alone the problem of treatment would be comparatively easy. Where the bone injury can be isolated from the joint and treated, as it were, separately, the difficulty is overcome by the exercise of mechanical ingenuity. But where the articular surface of the bone is seriously damaged, or a considerable portion carried away, where the stability and mechanics of the joint are in this way seriously involved—where the oozing of blood from the bone surface refills the joint with a nidus of devitalized tissue favourable to the growth of infecting organisms—where fissure fractures extend into the joint and provide a track for the constant supply to the joint of infection from a focus some distance away,—the problem is truly a difficult one and cannot be solved by any cut and dried rule.

Passing to the specimens which show the results of infection, you will note:

1. Erosion of cartilage at points of pressure and evidence that, where pressure does not operate, the destruction of cartilage is comparatively slow. Referring again to the specimen last shown (No. 2943) the outer facet of the patella in contact with the intact external condyle, is much more eroded than is the inner facet, which was not subjected to pressure inasmuch as the anterior articular portion of the inner condyle was detached and fell into the intercondyloid notch. This point is again demonstrated by comparing the site of erosion in infected knees complicated by supracondylar fracture of the femur with those in which the femur is intact.

2. Another point to be demonstrated is the presence of attempts at repair in spite of the acute infection existing. This is evidenced

by the deposition of callus on the bone, which is found always just at the margin of the area of active infection.

One outstanding feature of these cases, clinically, which cannot be shown on the macerated specimens, is the involvement of the soft tissues in the infective process. This is evidenced by suppurative bursitis and tracking abscess. The bursæ commonly affected are the one beneath the inner head of the gastrocnemius muscle which also sends a process to underlie the tendon of the semi-membranosus and the one forming a sheath for the tendon of the popliteus muscle.

One case (No. W.O.C. 2944) is of especial interest in that it illustrates the effects of infection primarily in the tibio-fibular joint and passing by this anatomic path to secondarily involve the knee joint. The soldier was admitted with a gutter wound of the left thigh extending over the outer side of the knee, splintering the head of the fibula The knee joint was not then involved but later showed evidence of effusion and infection.

4. Gunshot Wounds of the Brain. By Dr. E. W. Archibald.

I have here a few specimens to show the nature of wounds of the brain in the present war. I may preface my remarks very briefly by reminding you that in wounds of the brain from high velocity missiles, the pathological effect on the brain itself depends very largely upon the velocity with which the missile traverses the brain: the greater the velocity the greater the radiation of force at right angles to its path. The principle applies alike to the pointed bullet, the round bullet and the fragment of shrapnel. The consequence is that we do not get a simple drill hole unless the velocity of the bullet is low. If high we get a rather broadish track of destruction. So great is the expansile effect that high velocity bullets, shot at point blank range from the modern service rifle, have even been known to explode the skull and the brain has been found thrown clean out of the cranial cavity and lying two or three feet away almost intact.

The tracks are broad; they cause but little bleeding, except for petechial hæmorrhages. The passage of the missile may shower fragments along its path. This is seen more particularly in cases in which the bullet lodges, and also, of course, in cases in which the missile is a shell fragment. Occasionally a bit of the service cap or steel helmet may be included. The brain itself is lacerated.

I am able to show you in this specimen evidence of this laceration and of the width of destruction in this other specimen. The

entrance of the bullet was in the left occipital lobe. It tore through the dura and the posterior cortex on this side, causing this laceration. It has not only destroyed all tissues along its immediate path but also a certain depth of tissue on each side.

One might encounter next, one or two other things that occur with an ordinary brain injury. First, this broad path of necrosis is surrounded by an area of reactionary œdema, consequently there is swelling of the brain and therefore herniation into the open wound of the skull. That brings me to the secont point, which is the rarity of meningitis following upon these wounds. Infection, it is true, is carried in frequently by the missile, but the brain herniation blocks off any entry into the meningeal spaces. This rarity of meningitis was quite remarkable. Major Rhea and I were most interested in the first few months in looking for meningitis, and rather expected it to be frequent, yet in a series of thirty odd brains, we had only three cases of meningitis, and these were all metastatic (not cortical), from injury in some other part of the body.

These two points are the main ones I wanted to emphasize to-night.

I have a series of specimens here which illustrate various conditions; but they do not add very much to what I have already shown you in the previous specimen.

Here is one in which the effect was a gutter fracture. This is the surface of the brain; the fracture crossed the vertex and the amount of destruction with hæmorrhage is shown in the brain beneath. The effect was one due to radiating force which splintered the skull and lacerated the surface of the cortex.

Again, this specimen shows the path of a bullet passing through from front to back and you can here see the width of the destruction along the path of the bullet.

This other specimen represents a hæmorrhage into the ventricles from concussion. Here are the ventricles filled with blood. In this case there was only a small fragment embedded in the surface of the skull, not penetrating, but causing concussion such as to create bleeding which filled the ventricles with a regular mould of blood.

One word as to treatment. At first we used to drain. Some removed bone widely, others did not. Decompression was rarely necessary because compression was not menacing. With regard to potential infection, we learnt that the great thing with all wounds anywhere was to use the knife freely in excising the wounds, combined with such methods as the Carrel-Dakin solution and immediate

closure. In brain wounds we came gradually to the point of excising the wound both of scalp and of bone, curetting out the tract in the brain, removing by suction all necrotic brain mush, also the missile if it could be got easily (if not, leave it alone), and closing completely both dura and skin omitting drainage altogether. I speak of wounds got fairly early. This technique gave the best results.

5. Gunshot Wounds of the Abdomen. By Dr. F. A. C. Scrimger.

I have been asked to demonstrate a few specimens showing results of penetrating wounds of the abdomen. I remember the first introduction I had to penetrating war wounds of the abdomen was at a surgical meeting that was held in Boulonge in the Australian Hospital in March, 1915, when a discussion as to the advisability of operating on penetrating wounds of the abdomen at all was taken up. The opinion expressed then was that operating on these cases, as they were received, was useless. Of the surgeons who spoke at that meeting not one was able to report a case in which he had operated that the patient had got well. It was not so long after that, that special units were organized and sent to the front, that is, as near as possible to the line, for the express purpose of operating on these penetrating wounds of the abdomen.

These two specimens here show the reasons why that change of mind took place. The first specimen is a number of coils of small intestine showing multiple wounds, in several places the gut is entirely torn across. We have no knowledge of the history of this case, but in spite of the extreme tearing of the gut and the mesentery there is no sign of peritonitis. The gut is smooth, not dilated, not injected, and this also shows very well in one or two places the tendency that it had in the early stages to try to block off the peritoneum from soiling by the intestinal contents. The intestines were usually found lying, except for the tears, normally in the abdomen, which was filled with unaltered blood. The gut was usually found of normal size, not dilated, not injected, and at the early stages at least only a little smearing at the point of lesion.

One would hazard a guess that this man had died within ten hours of his wounding, probably from a combination of shock and hæmorrhage.

This specimen is obviously an operative one. A section has been resected as shown by the clamp near the end. It shows three through and through wounds of the small intestine and one

much larger one which is not through and through. It is a very good complement to the first specimen, showing a little later stage in the condition. The wounds are still bulging, the circular muscles have contracted, pouching out the mucosa into the wound and almost blocking it. There is probably not much smearing but it shows the beginning signs of peritonitis. It is a little later stage than the other, as is shown by the injection and the flakes of lymph on the surface.

It also raised a question that was frequently discussed among casualty clearing station surgeons, as to the advisability of the multiple suture in a case such as that, and the resection of the bowel as was evidently done here. The question was never really brought to a very definite agreement. Obviously there would be certain cases where no one would think of resection and others where one could do nothing else but resect. In this case I feel I would have attempted a multiple suture. I believe the tendency of the men doing these cases was to do a multiple suture whenever possible rather than the resection.

These two cases from abdomino-thoracic wounds raised also an interesting question that came up, first mentioned about August, 1915, by Major Lockwood, the Canadian who did such very good work in war surgery in the early days of the war. He spoke at that time of the relief from pain and distress that resulted from the closure of wounds of the diaphragm. When operations for penetrating wounds of the chest became more frequent, a suspected wound of the diaphragm was pretty generally held to call for imperative operation from the fact that the relief obtained by the suture of such wounds was often very striking. It was surprising the ease with which the diaphragm could be sutured through the chest. Generally speaking, four inches of the rib was resected in the axilla and the rent was then easily reached.

6. Gunshot Wounds of the Extremities. By Major F. B. Gurd.

The specimens I have brought with me this evening divide themselves into three groups. In the first group there are a number of tissues which demonstrate the different types of wounds of the extremities. There are seen several examples of perforating, through and through (T & T), exit and entrance (E & E) or traversing wounds, also numerous penetrating, lodging or entrance wounds, and superficial laceration of the tissues to which the name of gutter wound was given. In addition to these three types of

wounds I have a leg, the lower half of which has been torn off by a large shell fragment. It is presented, more or less, in its original condition as received by the casualty clearing station. This is the type of wound which may be described as a severe mutilating wound and which obviously necessitates amputation no matter whether seen early or late.

Of the dangers to life or limb arising out of gun shot wound other than pure mutilation or injury to veins and vessels there are chiefly two: The first of these is exemplified by our second group of specimens, namely, gas gangrene. This affection was feared in all wounds, whether of the extremity or of the torso, in which muscle tissue was lacerated. Perhaps the most important lesson which we learned from the war regarding this type of infection is that it was in the muscle and in the muscle tissue alone, that the bacillus ærogenes capsulatus and other members of the ærogenes group found a suitable pabulum for their growth and massive extension. Its ability to produce gas and a considerable amount of poison depends upon the presence of glycogen in the tissue. Owing to the presence of glycogen in both liver and brain, occasional cases were seen in which a more or less severe spreading gangrene took place.

Gas gangrene of the muscles is well seen in several of the specimens presented this evening. Here is seen the discoloured dark red, grayish pink, and olive green appearance which represents the various stages in the involvement of the muscle. The muscle bellies themselves are separated by gas, and the individual fibrils are also separated by vacuoles which represent the presence of gas in the muscle itself.

The invasion of the bacilli of the muscle tissue is readily explained by an examination of the microscopic picture. In the spreading edge the large deeply staining rods are readily made out, the muscle fibrils are swollen, stain more intensely with the acid stain, and although the fibril itself is larger in cross section than the normal fibrils of the same muscle it is found to be separated from its sarcolemma. There is a difference of opinion as to whether this space represents the site of gas collection simple, or of gas and toxic fluid, in any event microscopically there is always a space. The cause of death of the muscle fibril, and the production of a pabulum of dead animal matter for the bacilli is obviously due to the separation of the muscle fibril from its nutrient supply.

Those who have not seen cases of fulminant gas gangrene can hardly realize its rate of spread. Well established cases were

commonly seen at the casualty clearing station in from four to six hours after injury. Death occasionally took place as soon as three and a half hours after wounding, although as a rule the patients lived from fifteen to twenty-four hours.

The third group of specimens refer to streptococcus septic-æmias: One heart, a tricuspid endocarditis; another a pericarditis; and the spleen a white infarct. As compared to the total number of wounds treated the incidence of severe streptococcic infection was not great. There were, however, a comparatively large number of cases in which trivial wounds with but little focal reaction developed systemic infection and died with signs of endocarditis, cerebral emboli, and kidney and spleen infarcts.

There is one specimen which has to deal with the late results of wounds of the extremities. It is a specimen of a leg amputated for non-union of the femur, in the fractured end of the bone, the medulla is replaced anteriorly by fibrous tissue and the bone itself is covered with a similar tissue. There is consequently lack of nutrition of the bone end with loss of reparative power. The crureus muscle has been replaced almost entirely by dense grayish fibrous tissue. This results in fixation of the quadriceps tendons of the femur. In such a case no form of treatment such as manipulation, radiant heat, massage or electricity can give hope of any useful functioning of the knee joint. All sorts of things are blamed for stiffness of the knee joint in such cases. This specimen shows that the stiffness is due not to a Thomas' splint, nor to posture, nor to calipers in the condyles of the femur.

7. Pathological Aspects of Gunshot Wounds of the Extremities. By Major L. J. Rhea

This series of war lesions of bone were collected and prepared at No. 3 Canadian General Hospital (McGill). They are arranged so that those at one end show lesions of comparatively short duration, some but a few hours, while at the other end the oldest lesions are seen. If this will be borne in mind, the series will be more instructive.

I cannot go into the detail of the pathological lesions though there are certain points I wish to refer to. First, the great amount of injury to bones that the missiles used in the recent war may produce: as will be seen, bones may be broken into almost innumerable fragments and these fragments be comparatively far removed from their original situation. Not only may these fragments be widely displaced, but they may injure vessels or nerves, and lead to serious or even fatal results.

Aside from the immediate results of injuries to bones, the surgeon is especially interested in the later conditions: those that are associated with the ever-present infection in these wounds.

What infections do to injured bones is best illustrated in the series of knee-joint lesions, where the early results of infection are shown by loss of synovial membrane and the late ones by extensive long necrosis.

The fate of displaced fragments of bone is one of great importance to surgeons. Some of these specimens throw some light upon this question. This specimen with its numerous fragments which have been placed in the same anatomical relations as they were when amputation became necessary, shows fragments that are dead and being removed, and other fragments though displaced are not dead. To these latter periosteum was attached. These dead fragments would probably have been removed either by nature or the surgeon, or, if left, formed foci for long continued suppuration. That repair can take place in the presence of extensive infection is well illustrated in this specimen, where even in the presence of extensive infection new bone is being thrown about and between the fragments, bridging over the latter. The other points of interest can best be pointed out after the meeting when the collection is inspected as a whole.

MAJOR G. A. CAMPBELL, Officer-in-charge of Library and Museum at Ottawa, closed the Symposium with remarks conveying to the meeting the greetings of the Director General, and his regret that he was unable to be present, and the appreciation of the Authorities of the gratifying state of excellence which the collection had already reached in spite of initial difficulties in the earlier years of the war. In this regard deep indebtedness was expressed to those who were responsible for the collection of the specimens, Professor J. G. Adami, Dr. Arthur Keith of the Royal College of Surgeons, and Colonel Elliott, and also to Dr. Abbott, Curator of the McGill Museum, for the supervision of the preparation up to the point of the present finished article. It was felt that the collection should be made use of to the greatest possible advantage of all, especially by such demonstrations at Medical Societies as the present, and that a definite explanatory catalogue should be provided for all interested. Other branches of this Museum in course of preparation were Foreign medical apparatus, both from Allies and from captured German lines, plaster casts, etc., illustrating facial surgery, and *x*-ray plates. The whole would form a Museum of which the Canadian Army Medical Corps might justly be proud.